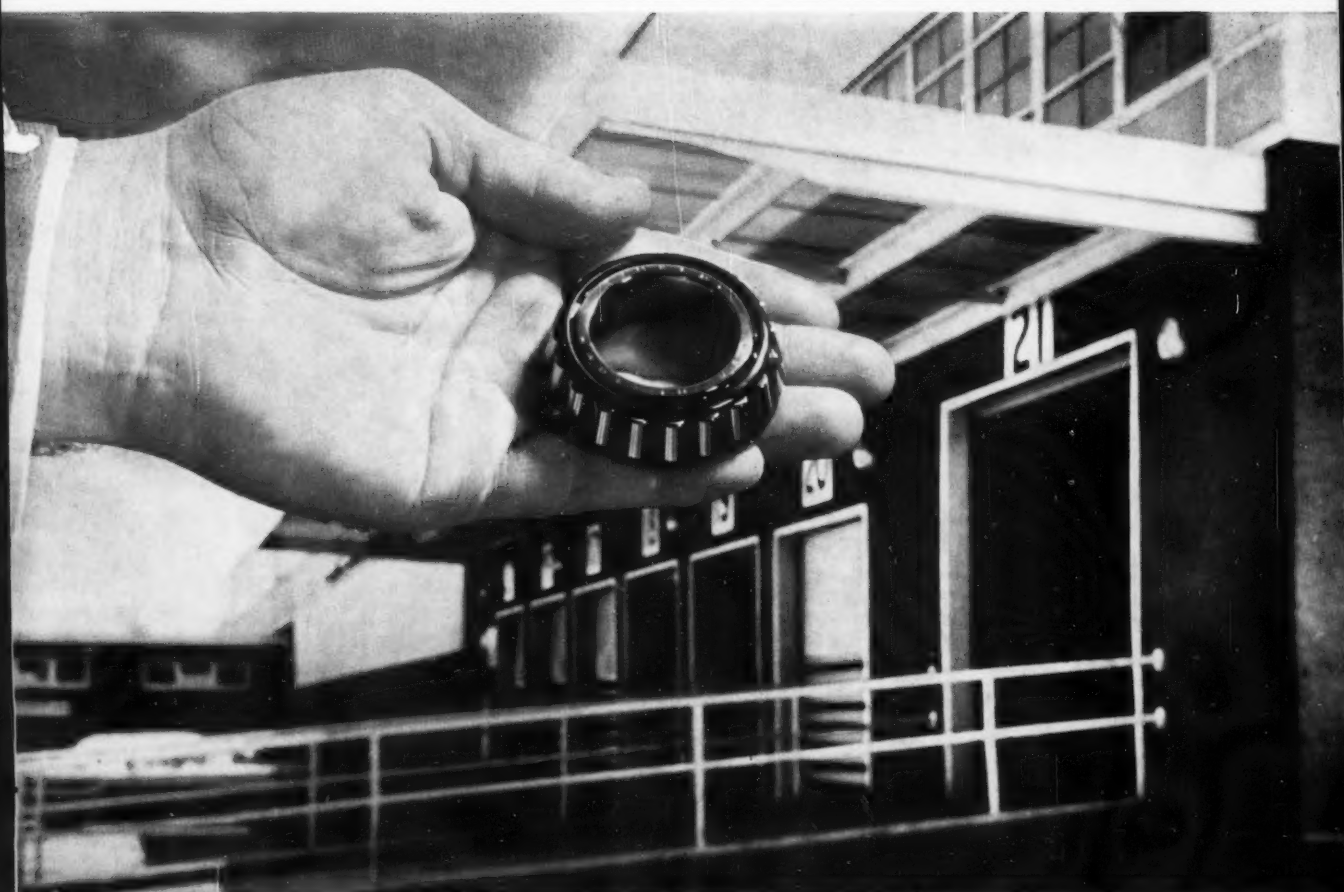
NOVEMBER, 1958 SIXTY-FIFTH YEAR

Machinery



it's mainly a matter of TIMING!

Knowing WHEN to replace obsolete equipment with a new Heald Bore-Matic saved over $54,000 a year!

A MACHINE doesn't have to be very old in years to be obsolete as far as production costs are concerned. And after all, the purpose of any machine is not just to produce, but to produce at a *profit*.

That's why replacement timing is so important. It depends not only on the age and productive capacity of the old machine — but on a careful cost comparison between the old and the *new*. Such a comparison, in terms of investment and return, will tell you when equipment should be replaced, and when it should be retained.

Our sales engineers are well experienced in making such obsolescence studies—on Borizing and grinding equipment. And they will be glad to do the same for you. Similar studies have pointed the way to many important savings.

For Example: A manufacturer of aircraft control equipment purchased a Heald Model 222 Bore-Matic to replace older equipment for boring, turning, facing and grooving on a wide range of parts. Later, their engineers made a detailed analysis on 12 different parts, to evaluate its cost-saving performance in specific terms. It was found that the machine would save over $54,000 in production costs — not only *paying for itself*, but netting a *profit* of over $29,000 in just the first year! The cost comparison, by groups of parts, is shown below.

	Old Method	New Machine
Annual Prod. Cost—Bodies	$53,004	$14,464
Annual Prod. Cost—Housings	18,124	4,917
Annual Prod. Cost—Carriers	3,276	1,404
Annual Prod. Cost—Plates	1,200	630
Total Cost per Year, all parts	$75,604	$21,415
Annual Saving for New Machine		$54,189
Total Purchase Price		$24,967
Net GAIN in One Year		$29,222

YOU pay for obsolescence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

HEALD ®

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

Published Monthly by
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BPA NBP

Machinery

NOVEMBER 1958 VOL. 65 No. 3

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

SHOP PRACTICE

MACHINE AND TOOL DESIGN

MANAGEMENT PROBLEMS

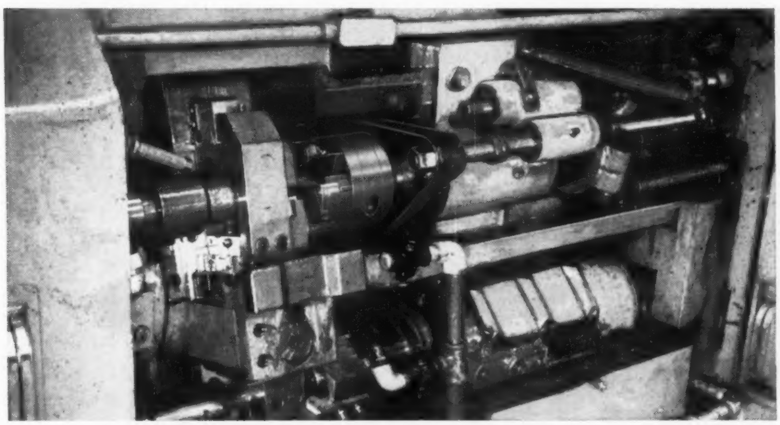
REFERENCE SECTION

DEPARTMENTS

SOCIETY of BUSINESS MAGAZINE EDITORS

Dollars in production time and tool cost are saved by using a LANDIS LANDEX Heat-Treated Revolving Die Head at the Grabler Manufacturing Co., Cleveland, Ohio.

1¼″ 12 pitch "V" form threads were cut on malleable iron union bodies by this LANDEX Head mounted on a New Britain Automatic in the left-hand third position (see illustration). 10 hours of continuous operation produced 6000 pieces before the chasers required regrinding.



The LANDEX Head, for application to bar automatics and other "live" spindle machines, has ample head rigidity allowing long life and high quality thread production. They offer low initial cost, permit rapid set-up, give trouble-free operation, and are easy to adjust. The outstanding tool life is the result of basic chaser design and over 50 years of LANDIS research and experience in manufacturing and hardening. For example, to ensure satisfactory die life, chasers are given special hardening when work piece design or material specifications so indicate. LANDEX Heat-Treated JN Heads are available in four sizes for threading all diameters from #4 to 2″. All can be equipped with oversize chaser holders for threading above their standard range.

For detailed information see your nearest LANDIS representative or write directly for Bulletin F-90.

LANDIS Machine COMPANY
WAYNESBORO · PENNSYLVANIA · U. S. A.

the world's largest manufacturer of threading equipment


Threading Machines


Die Heads— Rotary & Stationary


Taps—Collapsible & Solid Adjustable


Centerless Thread Grinding Machines


Thread Rolling Tools


Thread Rolling Machines

532C

OVAL GEARS

Fellows 36-Type Gear Shaper

Now...you can generate accurate oval and elliptical gears, and other irregular shapes, rapidly and economically. Once setup is made, production is as simple as in cutting conventional cylindrical gears. This new method minimizes the difficulty of wide variations in backlash experienced with such gears cut by previous methods. Full or modified involute teeth are produced to a higher degree of accuracy than was ever possible before on gears of this type.

Oval and elliptical gears are produced by continuously varying the center distance between cutter and gear during the cutting operation. A contour cam and a follower move the saddle the required amount in timed relationship with the rotation of the eccentric cutter-spindle adapter. The required pitch line contour of the gear is determined by the control cam and the eccentric adapter.

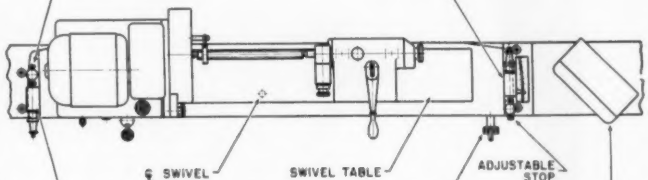
Although the Modified 36-Type Gear Shaper can be used to produce conventional external gears up to 18″ pitch diameter by substituting a cylindrical cam and concentric cutter adapter, it is primarily a special purpose machine for oval and elliptical gears. Special stroke parts are required for cutting face widths from 6″ to 10″. For full information, get in touch with any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

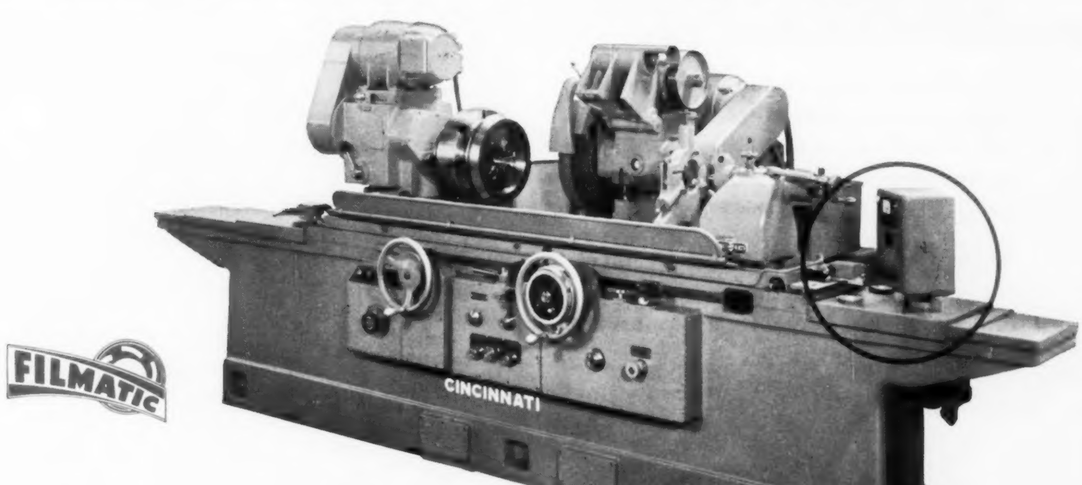
GAGE-LINE UNIT

taper ... quickly; accurately



Gage-Line elements are located for maximum convenience and visibility in setting up the machine.

Taper is an elusive factor in centertype grinding. The cut and try method of eliminating or correcting it is expensive and quite often wasteful of nearly-finished parts. Gage-Line is Cincinnati's answer to precise taper control. It is an electronic taper correcting unit which eliminates trial and error with amazing sureness and accuracy. ¶ Here's the way it works. A gage head is mounted on each end of the table, and an electronic control unit is mounted on the right-hand end of the machine. When the swivel table is adjusted, the control unit electronically translates the signal from each gage head to a graduated meter, reading direct for amount of movement and length of workpiece. Selector switches located on the control unit compensate the meter for different lengths of work, determine the range of magnitude desired on the meter, and select the signal from either the left-hand or right-hand gage head. ¶ Gage-Line unit is another forward step by Cincinnati in their continuing efforts to improve the accurary and reduce the cost of precision centertype grinding. Gage-Line is available for all CINCINNATI FILMATIC 4" to 14"L Plain Grinding Machines and 10" to 18" Universal Grinding Machines having between-center lengths up to 48" inclusive. Want more information? Ask for brochure G-687.

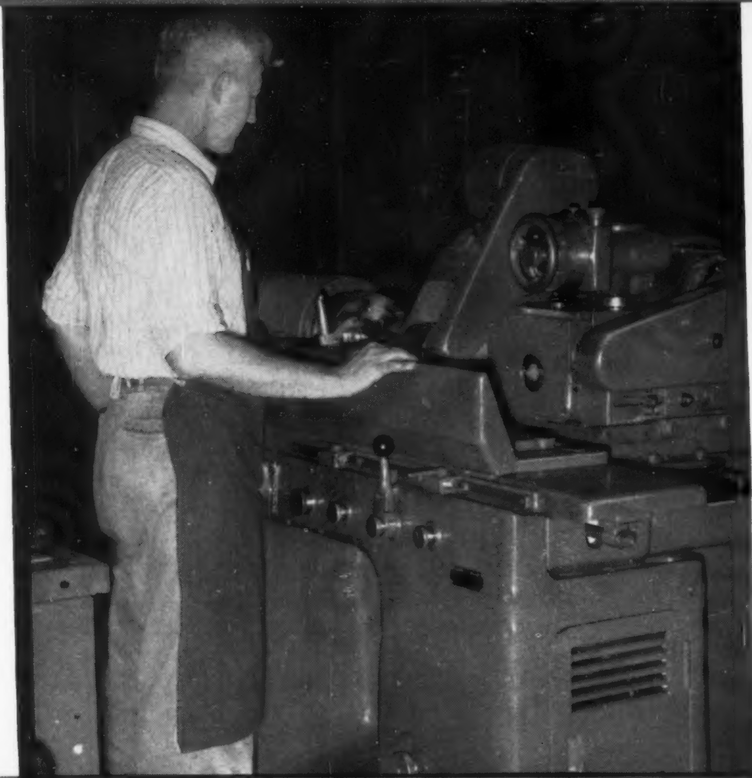


Gage-Line unit mounted on the bed of a CINCINNATI FILMATIC 18" x 48" Universal Grinding Machine. Detailed information on these fine precision grinders in catalog No. G-663-2.

MACHINES • MICRO-CENTRIC GRINDING MACHINES
CHUCKING GRINDERS • CENTERLESS LAPPING MACHINES

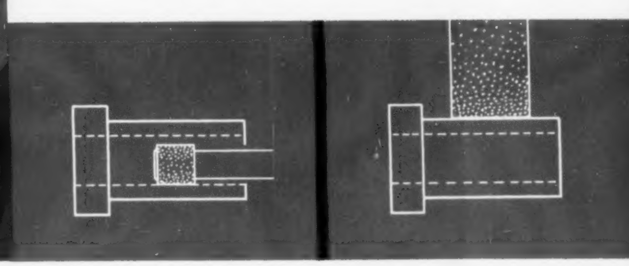
Grinding Machine Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

in profitable grinding operations



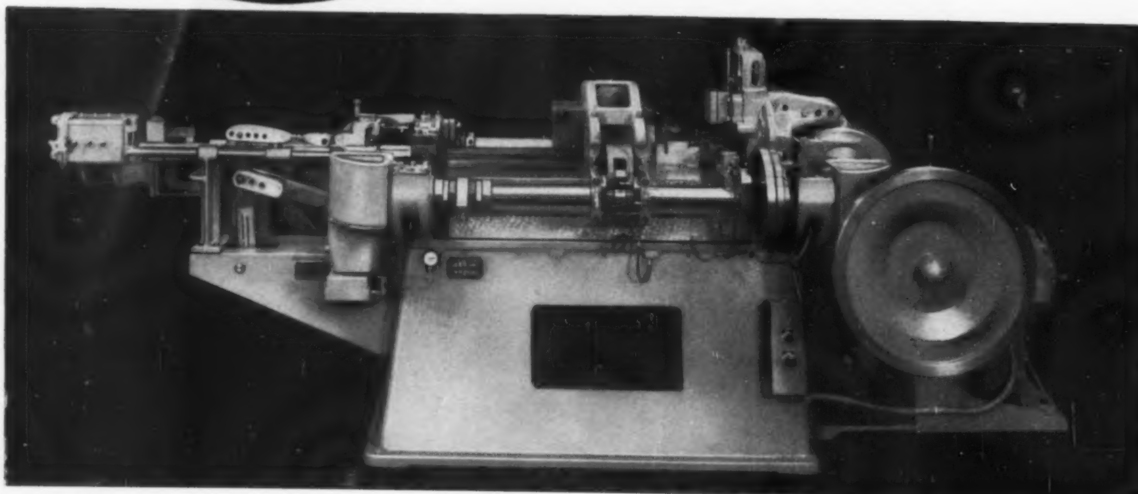
A west coast machinery manufacturer uses his Landis 10" x 20" Type H Universal to grind a wide variety of parts in small lots. Where set-ups are frequent, the convenience and flexibility of this Landis Universal saves time and raises production considerably.

Cycle time cut in half—grinding the I.D. and O.D. in one chucking. Drill bushings are shown here being ground to .0005" tolerance with .015" to .020" stock removal. This operation was formerly done on an engine lathe with a grinding attachment.



WAYNESBORO, PENNSYLVANIA

MULTI-SLIDE®



Model #35 U. S. Multi-Slide Machine in which 4 die heads (rams) can be used simultaneously.

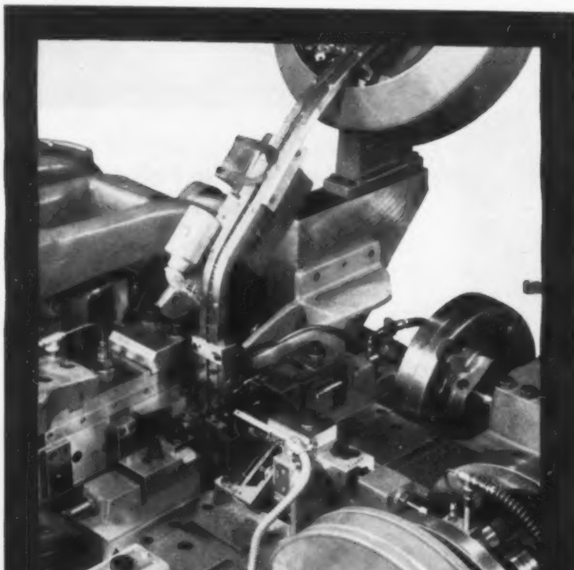


FIGURE 1A

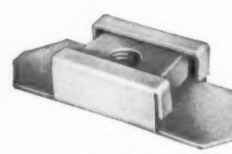


FIGURE 1

FIGURE 2

MACHINES

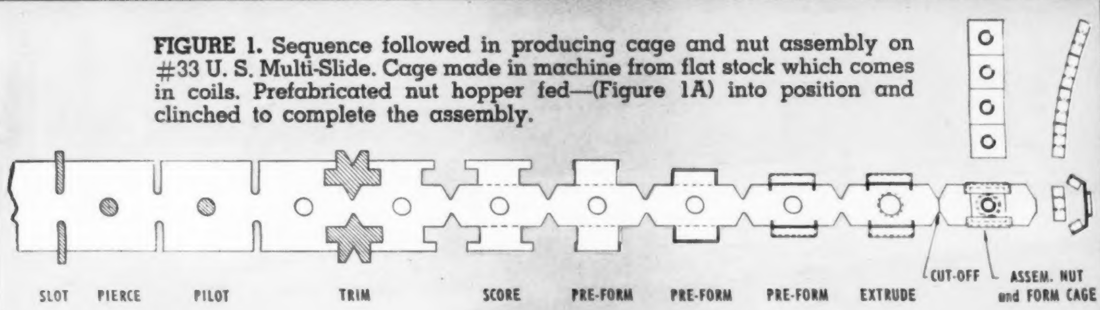
Reduce Pressroom Costs

The versatility of the U. S. Multi-Slide for the production of stampings, or assemblies which include stampings, enables you to reduce piece part costs by eliminating expensive secondary operations.

The various movements obtainable with the standard machine equipment allow for automatic production of intricately formed stampings—complete in one operation. Then, a variety of auxiliary attachments, available for use in conjunction with the standard movements, make it possible to go further and fabricate many different types of assemblies—**in the machine —a completed assembly at each cycle.**

Ask for a copy of Bulletin #15 (M) or, to compare manufacturing costs send in samples or drawings of the part you want to produce.

FIGURE 1. Sequence followed in producing cage and nut assembly on #33 U. S. Multi-Slide. Cage made in machine from flat stock which comes in coils. Prefabricated nut hopper fed—(Figure 1A) into position and clinched to complete the assembly.



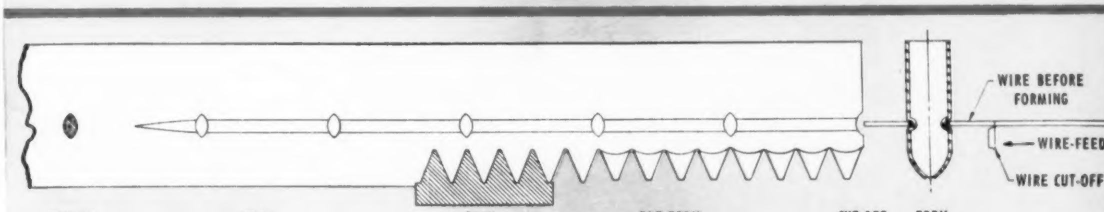


FIGURE 2. Tube reinforcement consists of a flat stock stamping and a wire part—both produced and assembled in a #35 U. S. Multi-Slide. Flat stock progressed from left to right and wire from right to left as indicated. Assembly completed in final forming position.

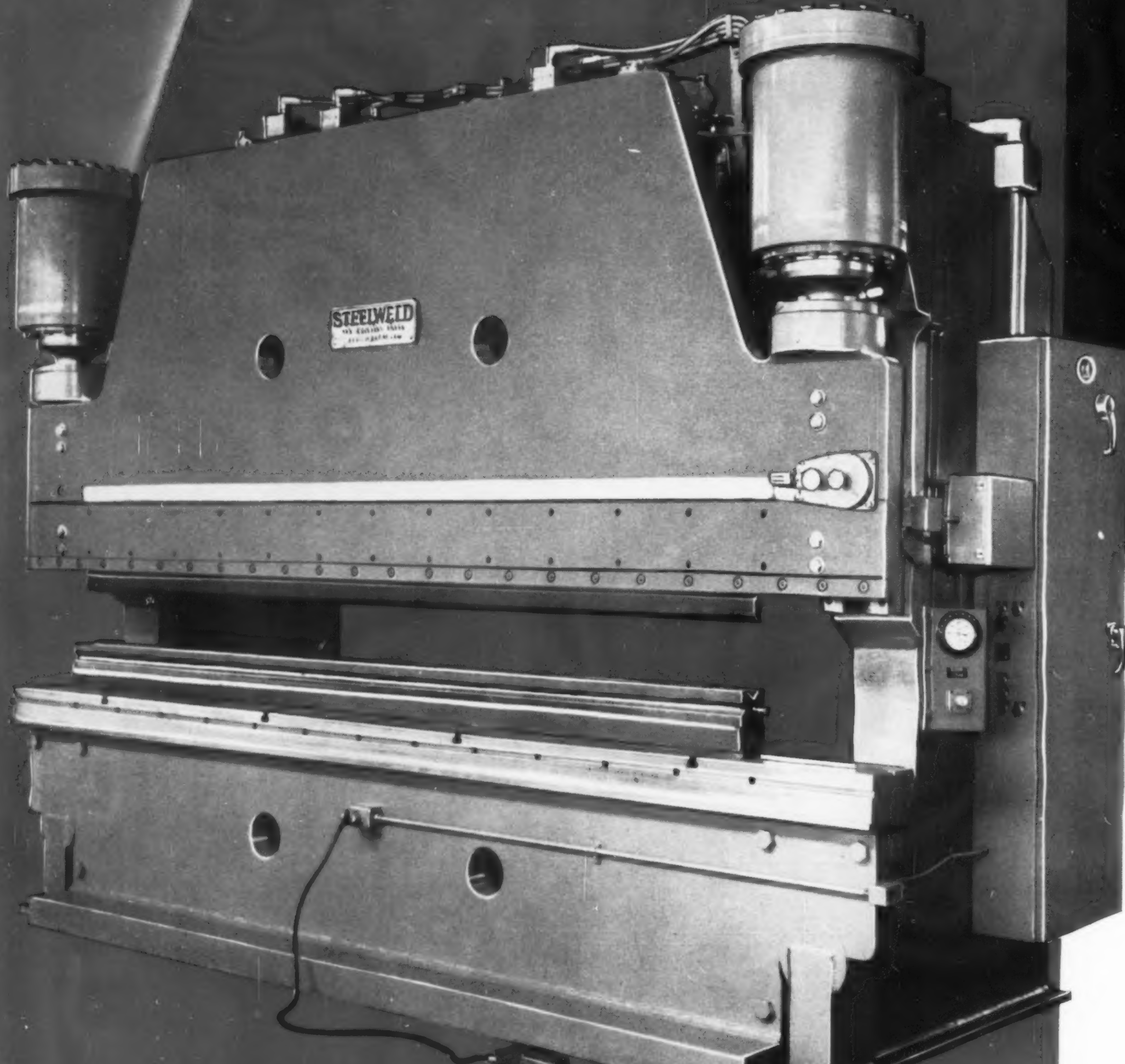
US PRODUCTS

U. S. TOOL COMPANY, INC.

AMPERE *(EAST ORANGE)* NEW JERSEY

U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

Introducing a



Write today:

Ask for free copy of Catalog No. 2024A

NEW LINE of

STEELWELD HYDRAULIC PRESS BRAKES

Capacities to 2000 Tons

- **Positive overload protection.**
- **Constant power during entire stroke.**
- **Ram reversible at any point.**
- **Stroke quickly adjusted for any length.**
- **Fast ram approach and return—slow-speed pressing.**
- **Operating pressure simply adjusted.**
- **Accurate ram level automatically maintained.**
- **Ram easily tapered.**
- **Simple, safe to operate.**

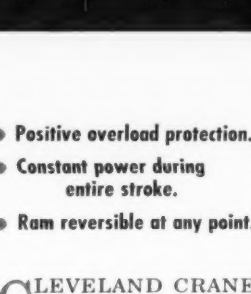
CLEVELAND CRANE is proud to present its completely new series of Steelweld Hydraulic Press Brakes for bending mild steel from 10 gauge to 2 inches and in lengths to 30 feet.

Heavily built and of finest quality throughout, the machines are of the most advanced design with all features found desirable for ease of operation, maximum production and outstanding performance.

Steelweld hydraulically operated brakes are versatile machines capable of handling a wide variety of operations. They are ideal for jobbing shops, as well as for mass-production work. They work to close tolerances and have ample speed.

The new line of hydraulic brakes supplements the Steelweld line of mechanical press brakes, which Cleveland Crane has been building for more than 25 years, but does not supplant it. Each type of machine has its advantages and careful consideration must be given to the specific application to determine the type and size machine most suitable.

We urge you to get the facts on these new machines that have so much to offer you. Our sales engineers will be glad to give you the details. Or write for our new catalog below.

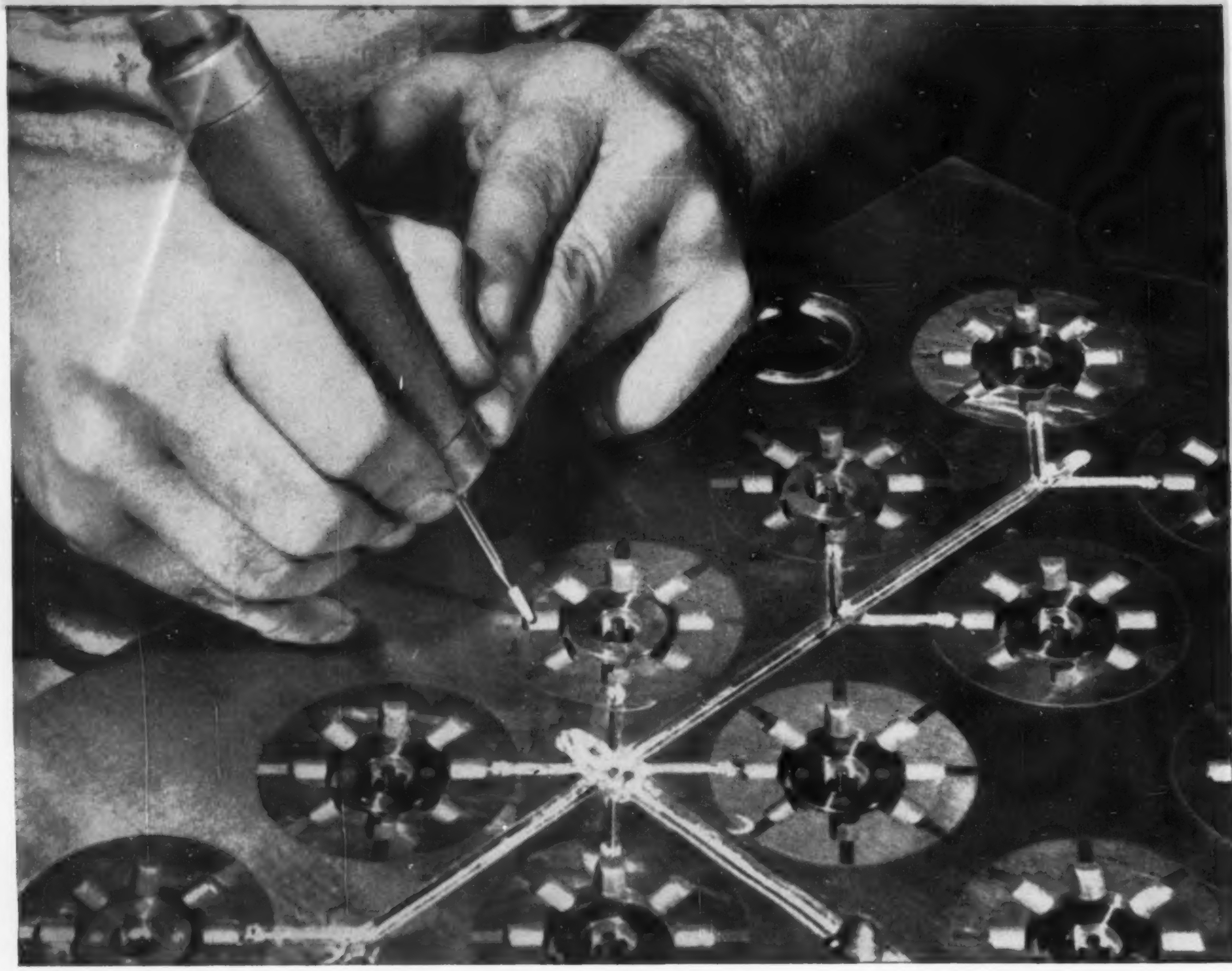


STEELWELD PRESSES

THE CLEVELAND CRANE & ENGINEERING CO.

5469 EAST 281 STREET, WICKLIFFE, OHIO

32 ALUNDUM* Abrasive for your tool and die jobs



Here's how Norton keeps

"Making better products... to make your products better"

Our motto is constantly being proved by our customers. Norton mounted wheels, for example, are hitting new highs in grinding efficiency. Outstanding new developments in abrasives and wheel construction eliminate loading and glazing, assuring best possible results in:

TOOL AND DIE GRINDING

Norton mounted wheels with sharp 32 ALUNDUM abrasive and VBE bond are the very best performers.

Advantages: Wheels need no costly dressing, hold form and give constant cutting action from start to finish — right down to the mandrel. "Best I ever had," reports a long experienced die finisher.

ROUGH GRINDING

For steel castings and weldments, mounted wheels of tough 44 ALUNDUM abrasive with VBE bond, and metal-mounted, are unequalled.

For snagging cast iron, wheels of sharp 32 ALUNDUM abrasive with VBE bond, and metal-mounted, outperform silicon carbide wheels consistently.

Advantages: Norton wheels give you the fastest cutting rate, with a marked increase of stock removed per wheel. "There has never been anything like them for speed and economy in our snagging," says the foreman of a leading foundry.

32 or 44 ALUNDUM Abrasive for your rough grinding

METAL-MOUNTING — *Another Norton Exclusive — You throw nothing away but the mandrel!*

Norton does it again! The mounted wheels are so securely anchored to the mandrel — *you use all of the abrasive!* No waste . . . all work! This radically improved method of locking the abrasive body to the mandrel is used on mounted wheels in most sizes and shapes, 5/16″ diameter and larger. Molten metal, injected into the abrasive recess at high pressure, does it — and does it fine!

Every Norton mounted wheel is accurately trued *after mounting* on rust-proof stainless steel mandrels. Developed to increase the time-and-money-saving "Touch of Gold," Norton mounted wheels are stocked in approximately 200 standard shapes and sizes. See your Norton Distributor for prompt deliveries. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

W-1879

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEHR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes


NEW

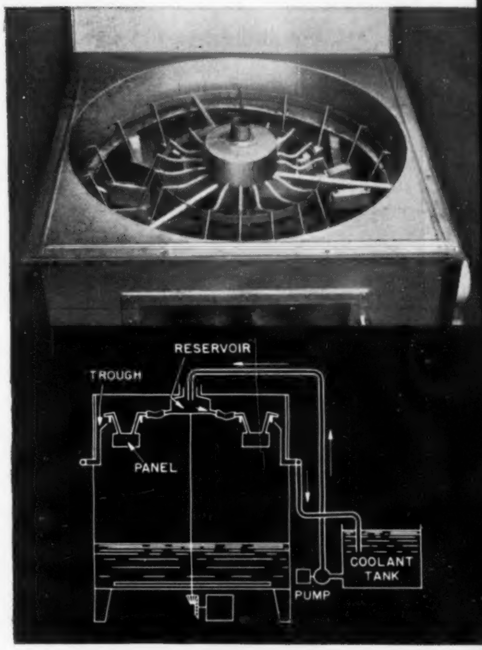
from Standard Oil THE MAGIC BOX

Corrosion steals $5.5 billion from industry annually. Standard Oil is in the forefront of the fight to control this loss. Standard's research scientists have developed a new method for measuring the effectiveness of rust preventives. This new test takes less than one-twentieth of the time of previous tests—and is about three times as precise.

Using a controlled humidity cabinet for testing corrosion, these Standard research men installed a system for cooling metal test panels (previously treated with rust preventive) so that their surface temperatures are lower than the temperature in the cabinet. Temperatures of panel surfaces and of cabinet atmosphere are held accurately. Controlling the temperature of the panels controls the rate at which water condenses on them. This in turn (for the first time) permits accurate control of the amount of condensation on the panels. Rust preventives are more speedily and precisely tested. Science, as a result of this work, has a new tool with which to test corrosion.

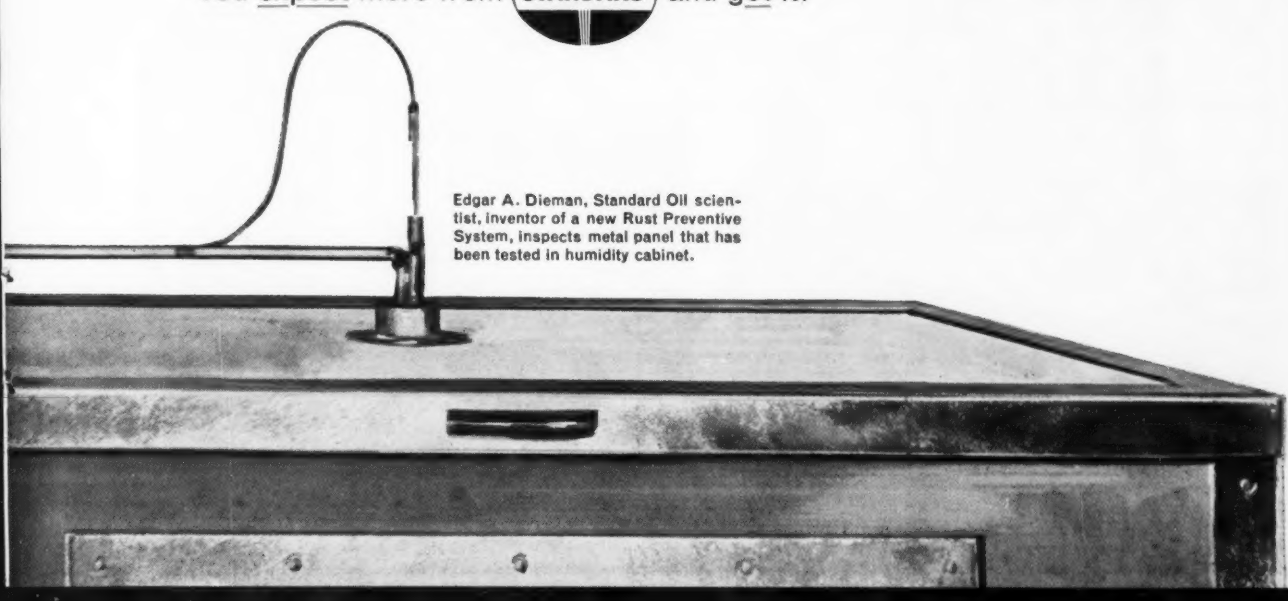
This is the research pay-out industry receives from Standard Oil. This is the something extra that backs up the Standard Oil industrial lubrication specialist who calls on you. This is the something extra found in the products he has to sell.

To know more about how Standard Oil industrial lubrication specialists—and Standard's research program—can help you, call the Standard Oil office nearest you in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

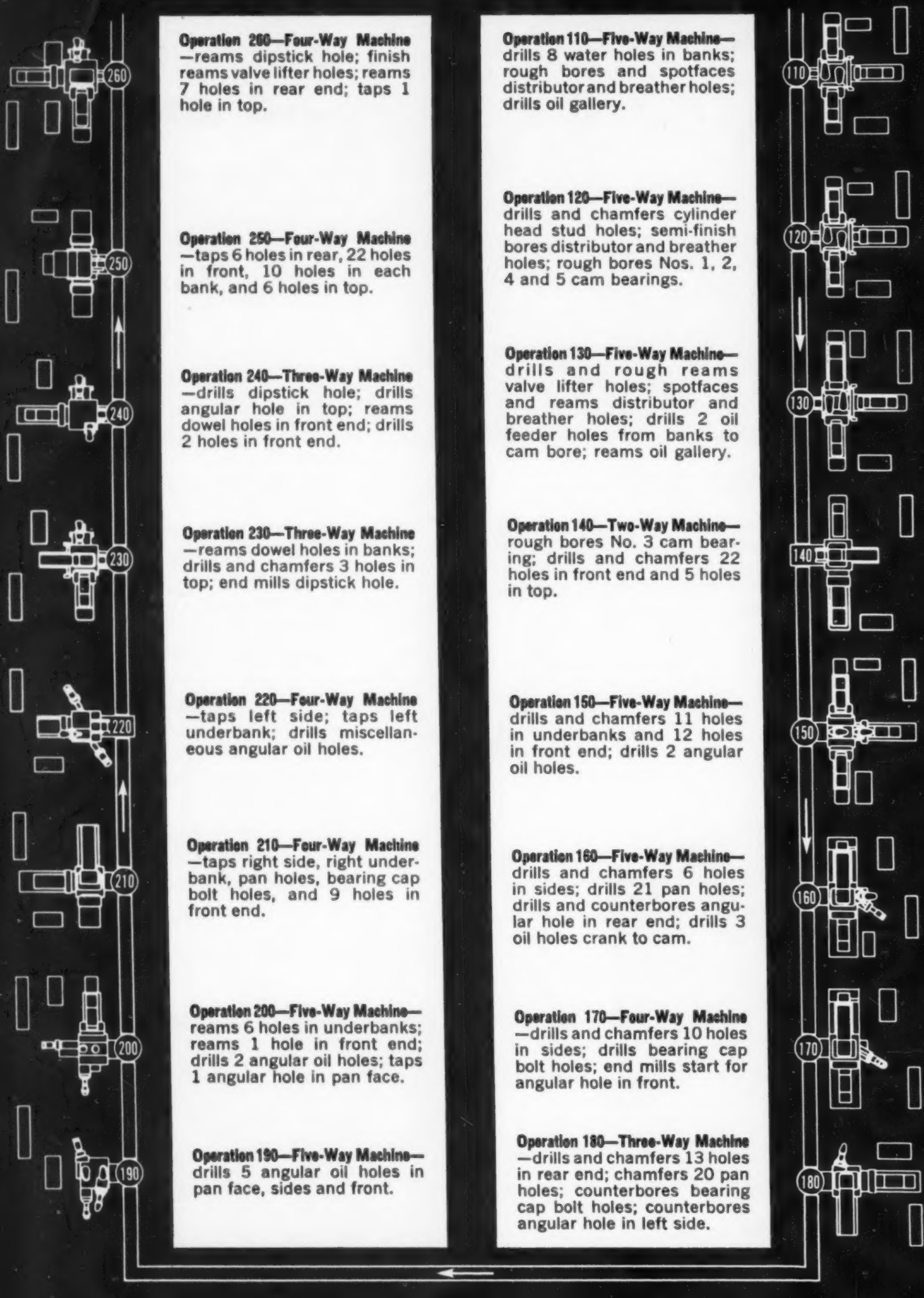


Top view and cross section of Accelerated Corrosion Test cabinet.

You expect more from STANDARD and get it!


Edgar A. Dieman, Standard Oil scientist, inventor of a new Rust Preventive System, inspects metal panel that has been tested in humidity cabinet.

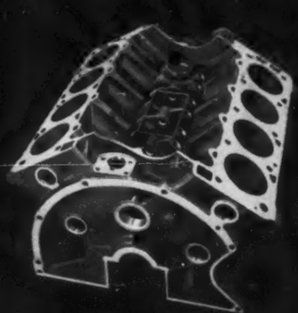
Automation for Low Volume Production



Floor plan of 16 single station machines for processing cylinder blocks

More Specials by Cross

Five-way machine operation 120



Here is a new kind of manufacturing line—one that utilizes automation for low volume production. It machines truck engine blocks at the rate of 15 per hour.

The unique material handling arrangement for the line permits one operator to take care of several of the 16 machines. To load any machine, the operator merely places the part on the turntable, rotates it 90 degrees, moves it about six inches toward the machine and pushes the cycle button. The machine then takes hold of the part, draws it into the work holding fixture, locates and clamps it, performs the machining operation and ejects it back onto the turntable—all automatically.

Other features include: complete interchangeability of all standard and special parts, construction to JIC Standards, hardened and ground ways, hydraulic feed and rapid traverse, and automatic lubrication.

Established 1898

THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

Weldynamics

ARC WELDING AT WORK CUTTING COSTS

WHY WELDORS AND MANAGEMENT LIKE IMPROVED FLEETWELD 47

Improved Fleetweld 47 gives that fast, easy operation . . . yet it isn't limited to the flat position.

Weldors appreciate the smooth flowing action!

Management loves the cost-cutting speed and versatility.

Try Improved Fleetweld 47 on your next flat and uphill production job. You'll love it too! It conforms to AWS E-6013 and E-6014.

Write for the *new* Weldirectory Bulletin 7000.1.

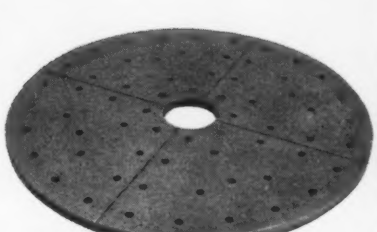
Lincoln men who know Weldynamics will help you establish procedures, select equipment and electrodes for most efficient, low-cost welding.

The World's Largest Manufacturer of Arc Welding Equipment

LINCOLN

THE LINCOLN ELECTRIC COMPANY, DEPT. 1230, CLEVELAND, OHIO

Wide variety of Gardner abrasives assures top performance in all surfacing operations

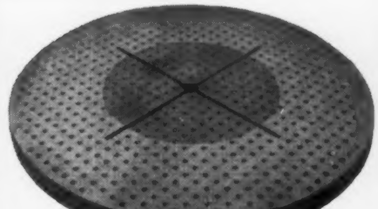


Segmental Wire-Lokt® discs for large horizontal grinders

Smooth faced Wire-Lokt discs for general purpose grinding

Narrow face disc with corrugations for cool cutting

Cylinder wheels for use on most popular types of vertical spindle grinders



Combination grade and face with radial lines for even wear and better coolant distribution

Cylinder wheels with square centers for fast stock removal on large areas

range of disc sizes

	diameter	thickness
regular disc	10″ to 48″	1″ to 3″
segmental disc	53″ to 84″	1″ to 3″
cylinder wheel	11″ to 32″	4″ or 5″
square center cylinder wheel	18″ & 20″	4″ or 5″

For a review of your flat surface grinding operations, call your Gardner Abrasives Specialist today.

GARDNER

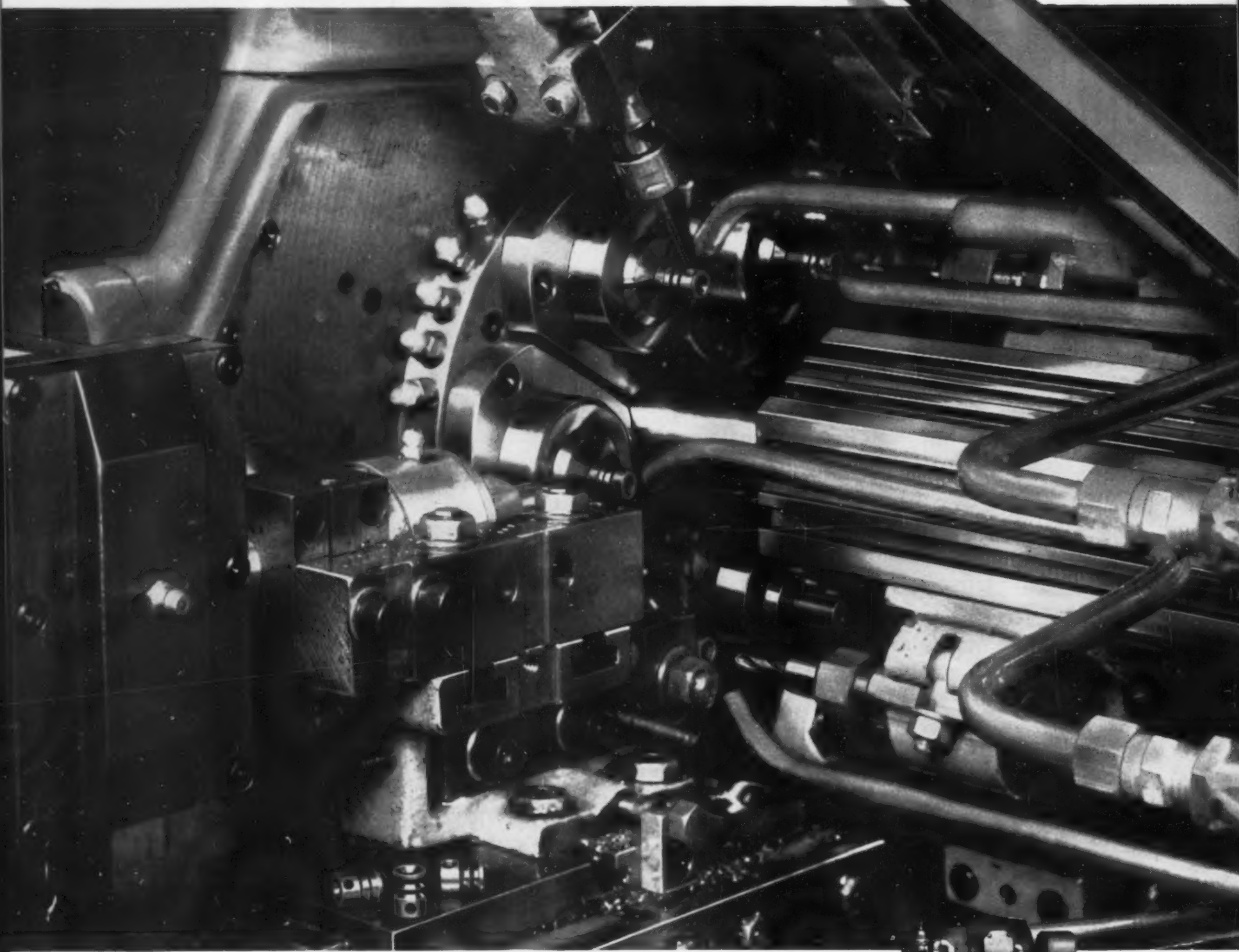
abrasive discs

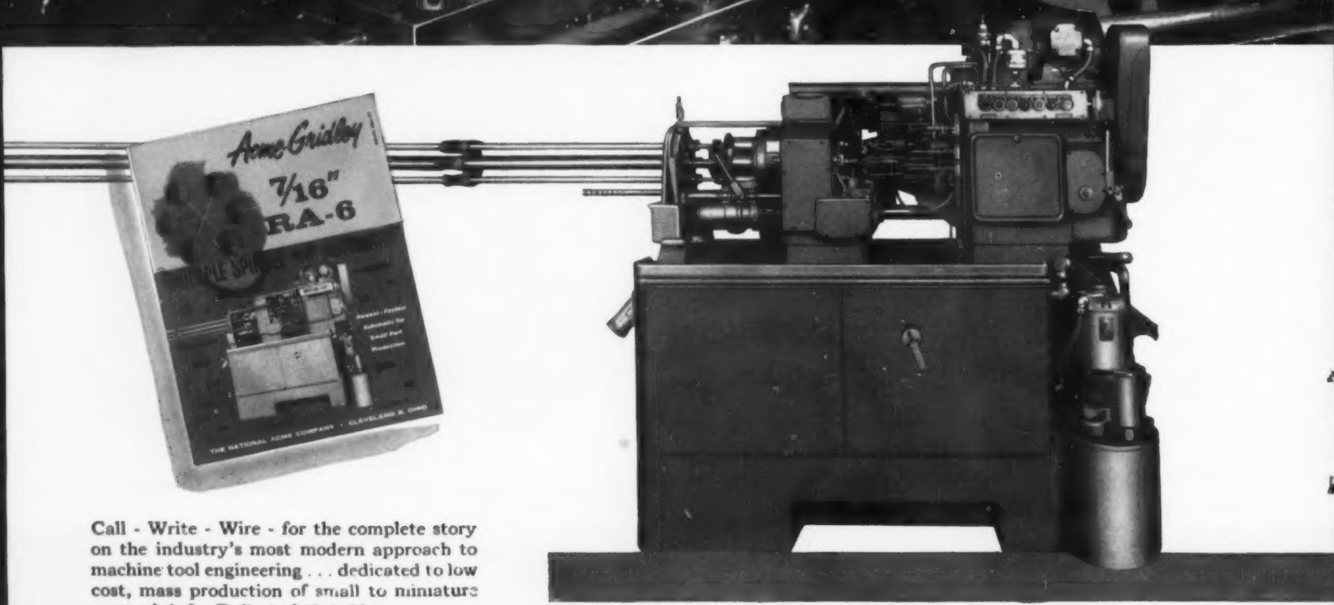
BELOIT, WISCONSIN

GRAY Universal Planer shown in operation at the Baltimore plant of Koppers Company, Inc., Metal Products Division.

new planer

Unusually large tooling zone permits ready access for installation and adjustment of tools and attachments.





Call - Write - Wire - for the complete story on the industry's most modern approach to machine tool engineering . . . dedicated to low cost, mass production of small to miniature parts. Ask for Bulletin MRA-58.

MEL-TROL®
at work

You get good, predictable performance from a solid cold heading die only when the die steel you use is uniformly tough and strong through the core of the bar. But the core of the bar can only be as uniform as the core of the ingot it came from.

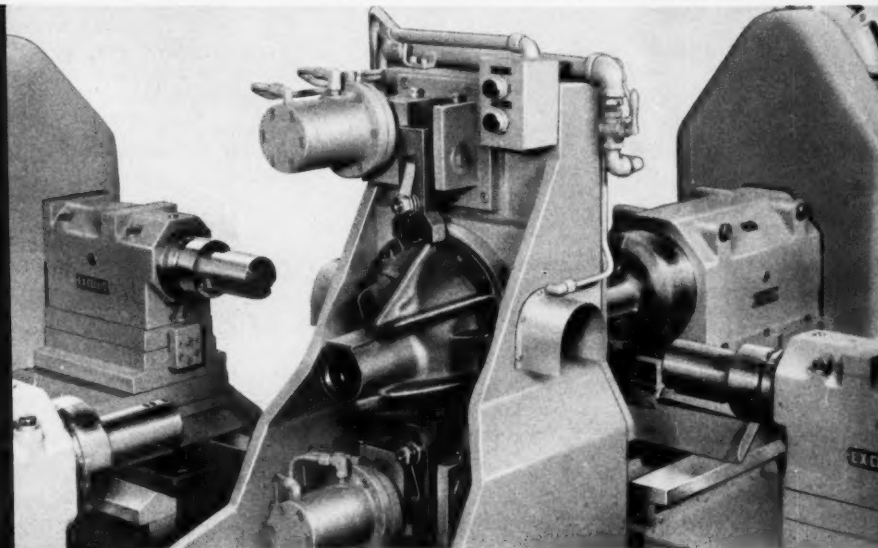
That's why *Carpenter* developed the MEL-TROL process. MEL-TROL uses the best quality control tools made, precise melting techniques, and an exclusive, patented ingot design, to turn out tool and die steels—such as H-9 Double Header for cold heading dies—that are more uniform through the center and have greater freedom from segregation and flaws than any other tool and die steels sold today. A call for H-9 Double Header to your nearest *Carpenter* representative—right now—is your very best answer to the problem of unpredictable performance in cold heading dies.

Carpenter STEEL

The Carpenter Steel Company, Main Office and Mills, Reading, Pa.
Alloy Tube Division, Union, N. J.
Carpenter Steel of New England, Inc., Bridgeport, Conn.
Webb Wire Division, New Brunswick, N. J.

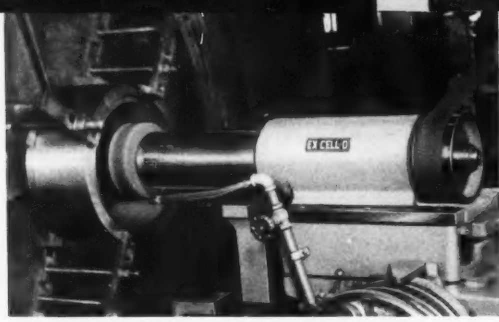
EX-CELL-O Precision Production News

COST-CUTTING IDEAS FROM EX-CELL-O CORPORATION — DEVOTED TO MINIMIZING COST OF PRODUCTION

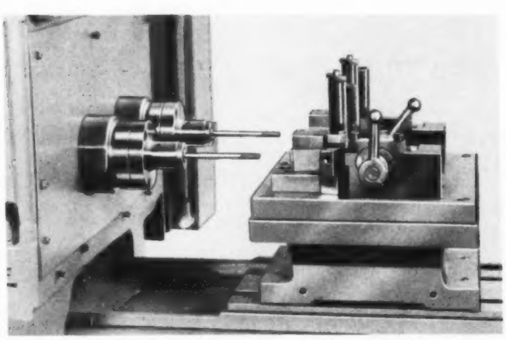


Exacting limits are held by Ex-Cell-O Precision Spindles boring pinion bearings and cross hole in this automotive differential carrier. Pre-loaded ball bearing construction of Ex-Cell-O Spindles plus sealed lubrication insure long life and low maintenance.

58-32A



Internal grinder uses belt-driven spindle to grind 10″ I.D. to closest tolerances. Belt-driven Ex-Cell-O Precision Spindles are available in a full range of speeds up to 25,000 rpm.



Two Ex-Cell-O Precision Spindles are used in this Bor-Drilling setup to drill jet engine blades with extreme accuracy. Ex-Cell-O Spindles hold critical limits in either ferrous or non-ferrous metals.

Do More Jobs— More Accurately

Standard Ex-Cell-O Precision Boring and Grinding Spindles cut costs in precision production

Installed as original equipment or as replacement components, standard Ex-Cell-O Precision Spindles put job-engineered efficiency into every job—surface grinding, I.D. grinding, precision boring and other applications.

Whatever the type—belt driven, air driven or motorized, designed for standard current or high frequency applications—Ex-Cell-O Spindles have earned an enviable reputation throughout the world for precision and versatility, for long-lasting operation, and for production savings.

Pre-loaded ball bearing construction, absence of vibration and chatter and low maintenance make Ex-Cell-O Spindles first choice for close-tolerance, fine-finish work. Spindles also are available with heavy duty bearings for roughing and semifinishing operations.

Your local Ex-Cell-O Representative can give you all the details, or write direct.

3 MORE COST-CUTTING IDEAS

EX-CELL-O PRECISION PRODUCTION NEWS

This is cost-cutting— with CTW Carbide Broaches

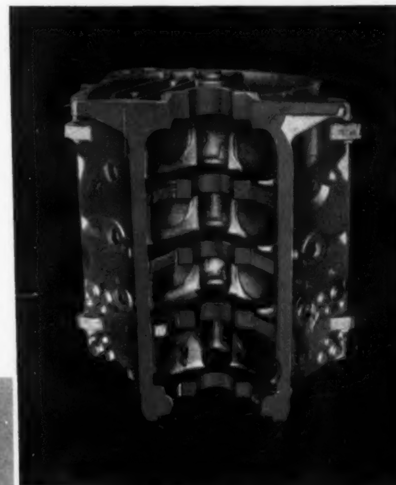
Continental Broaches increase output and reduce downtime in automobile engine block production

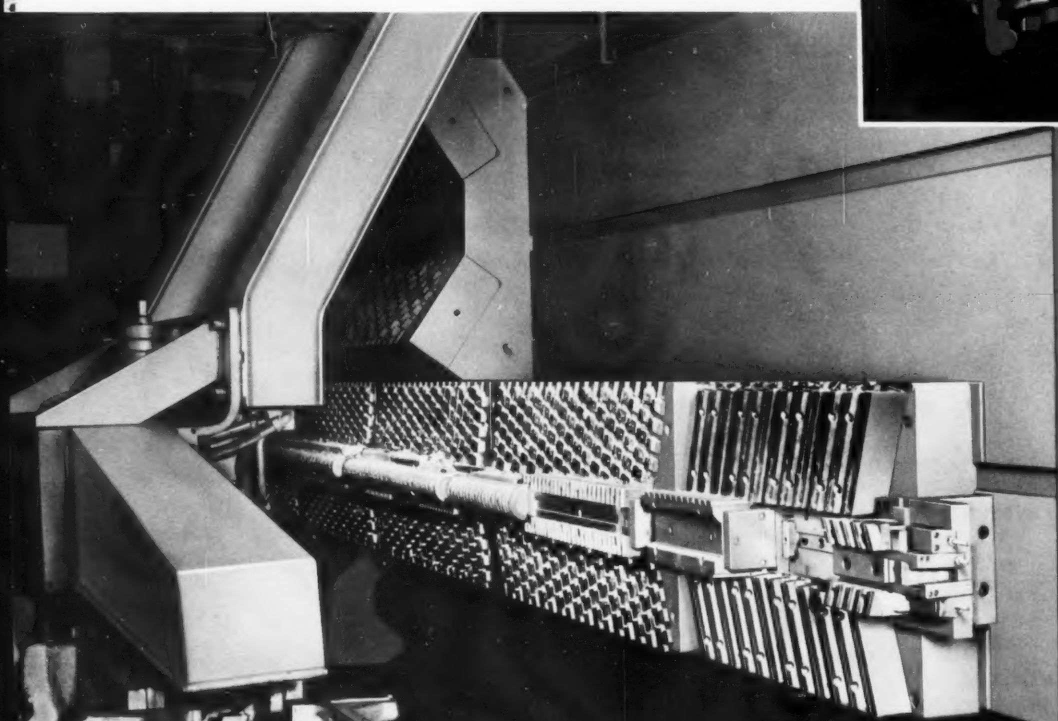
Greater production with less downtime are just two of the important reasons why a large automobile manufacturer uses Continental tooling for broaching of pan rail, half bores, bearing locks and parting faces of V-8 engine blocks.

Removing a maximum 3/16" stock in a single pass, this five-section, combination half-round and face broach uses carbide-tipped tool bits and broach inserts to semifinish and finish 20,000 to 22,000 cast-iron blocks between tool resharpening.

This automotive operation proves again why the production savings made possible by Continental tooling makes the "best cost less" than ordinary broaches.

58-32C





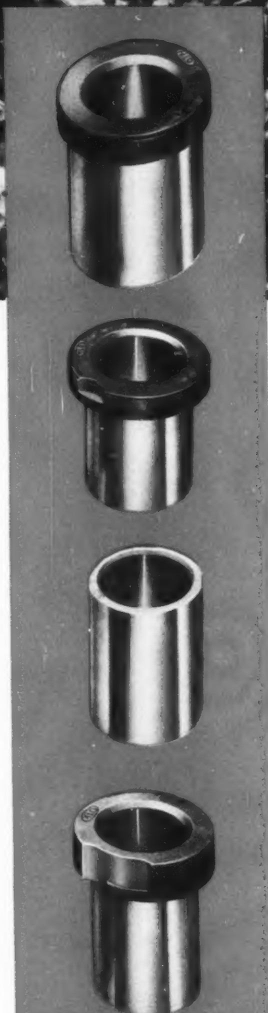
Above: In a single pass, multiple surfaces of this cast-iron engine block are semifinished and finished. Maximum stock removal is 3/16".

Left: Continental Broaches used in this horizontal surface broach machine are made up of five sections combining half-round and facing broaches. Tool bits and broach inserts are 100% carbide-tipped.

CONTINENTAL TOOL WORKS division of EX-CELL-O CORPORATION

EX-CELL-O PRECISION PRODUCTION NEWS

58-32D



Make the scrap-pile test!

Start using Ex-Cell-O Drill Jig Bushings today—then watch how worn-out bushings disappear from your scrap-pile!

The reason is simple: Ex-Cell-O Drill Jig Bushings last longer because they're made better!

The answer lies in the chrome-alloy bearing steel used in Ex-Cell-O Bushings; in up-to-date automatic heat treating methods; in hole hardness quality-controlled to uniform 62-64 Rockwell "C"; and in Ex-Cell-O's own high standards for precision-ground finish inside, outside and under the head for perfect seating.

All this—plus immediate delivery to your plant from the large Drill Jig Bushing inventories Ex-Cell-O maintains at key points throughout the country.

You get fast service on special sizes, too, because Ex-Cell-O stocks many semifinished bushings in addition to the more than 10,000 standard sizes always on hand.

For "same-day" shipment, order from Ex-Cell-O Corporation at Detroit, New York, Cincinnati, Downey, Calif., or London, Canada. Call your local Ex-Cell-O Representative or write direct for an Ex-Cell-O Drill Jig Bushing catalog today.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES CUTTING TOOLS • TORQUE ACTUATORS RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

XLO
EX-CELL-O FOR PRECISION

Got a pain in the neck?

IF GRINDING PROBLEMS ARE GIVING YOU A PAIN IN THE NECK, SWITCH TO CINCINNATI (PD)° WHEELS. For *now* CINCINNATI Grinding Wheels offer POSITIVE DUPLICATION— a remarkable achievement in precision manufacturing and quality control that *can save you money . . . and increase your production.*

And we're definitely not sticking out our neck when we make these claims, because through the CINCINNATI (PD) Manufacturing Process you are assured Positive Duplication of the original wheel *every* time you reorder. "On grade" with a CINCINNATI (PD) WHEEL means all future (PD) WHEELS will act and grind exactly alike.

Yet CINCINNATI (PD) WHEELS *are priced no higher than ordinary wheels.* So, we think you'll agree it's worth investigating CINCINNATI (PD) WHEELS right away.

Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

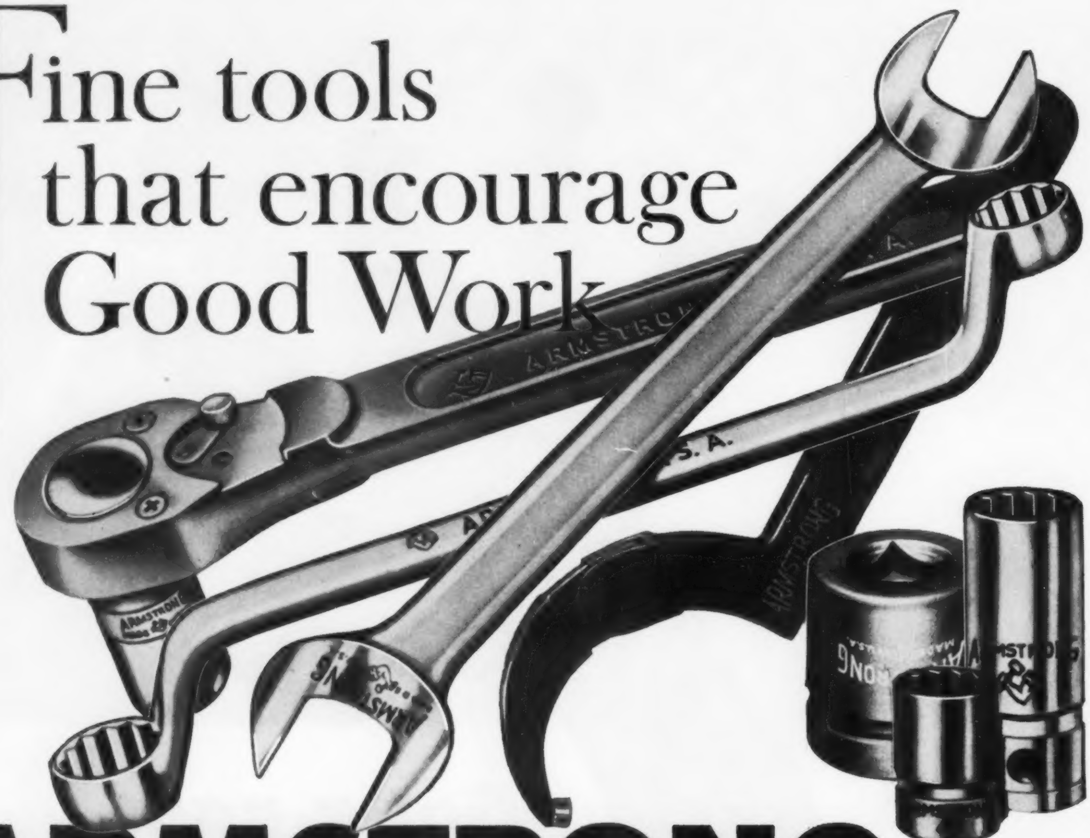
Remember—*only* CINCINNATI Grinding Wheels give you . . .

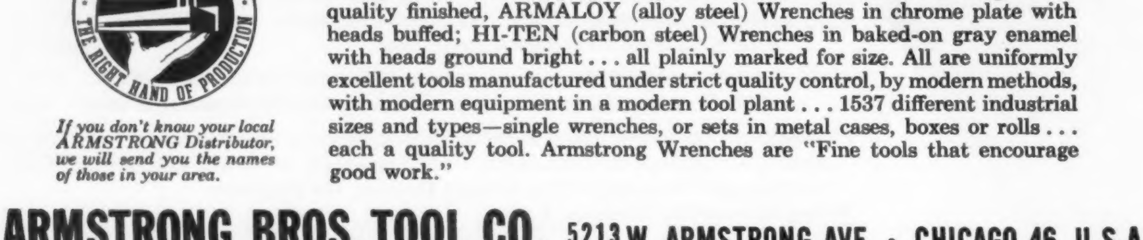
(PD) POSITIVE DUPLICATION.
°Trade Mark Reg. U.S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

CINCINNATI°
Grinding Wheels

For more data on any products advertised this issue use card, page 189


ARMSTRONG

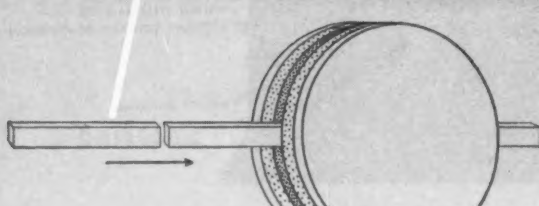


Disc grinder finishes **two** parallel surfaces in **one** operation

. . . Gardner grinder with feed thru work fixture

- gives continuous high production
- assures lowest unit grinding cost
- grinds to precision tolerances

Gardner 2H30 precision double spindle grinder with feed thru fixturing



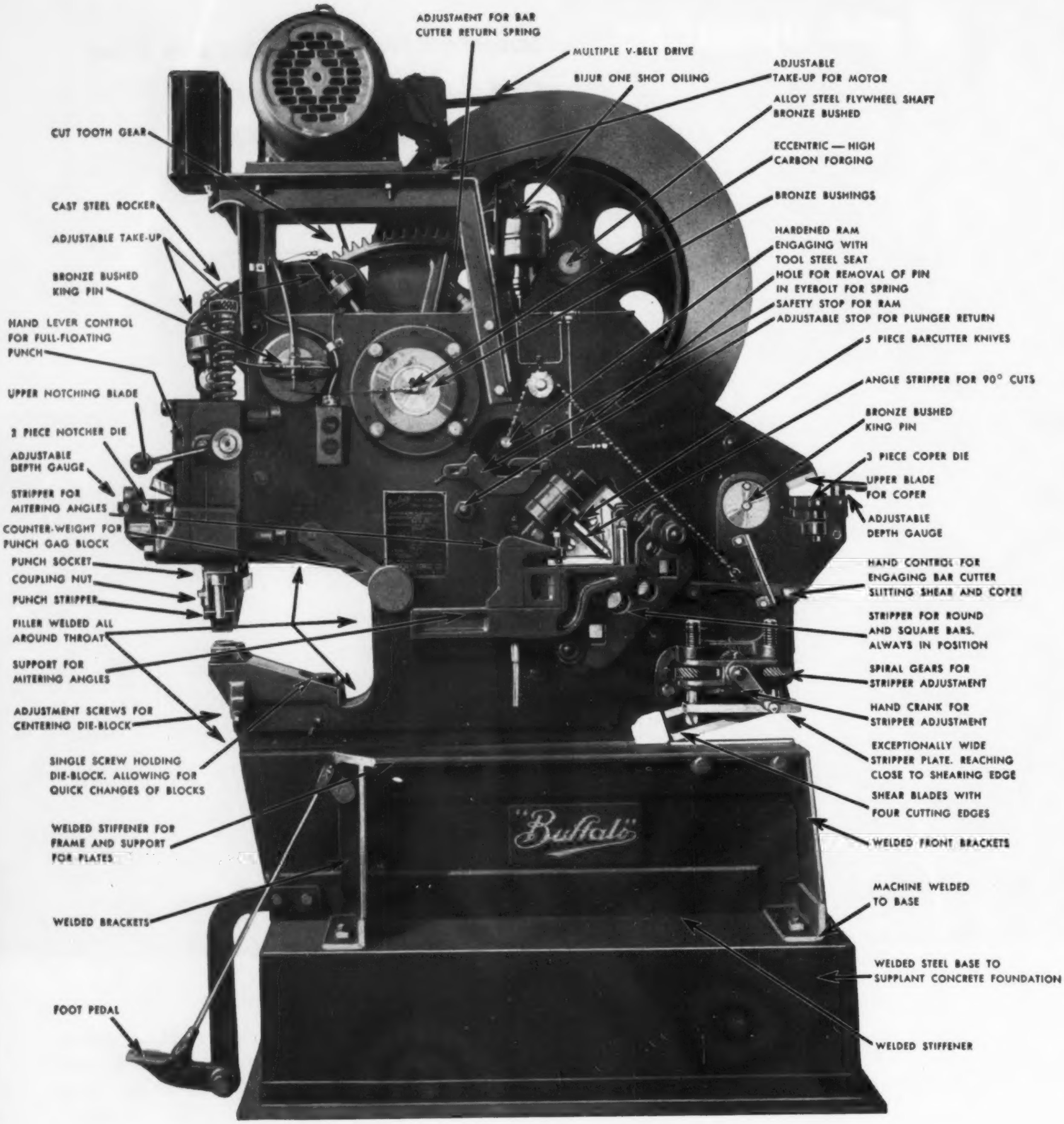
Feed thru double disc grinding

Typical parts: . . . . bearing races, covers, plates, runner bars
Production: . . . . 2000 to 6000 parts per hour
Stock removal: . . . . .010″ to .020″
Flatness: . . . . .0001″ to .0006″
Parallelism: . . . . .0001″ to .0007″
Uniformity: . . . . .0008″ to .001″

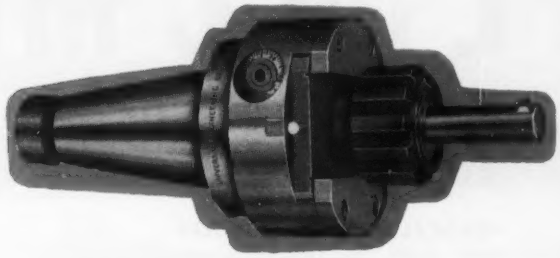
GARDNER

precision disc grinders

BELOIT, WISCONSIN

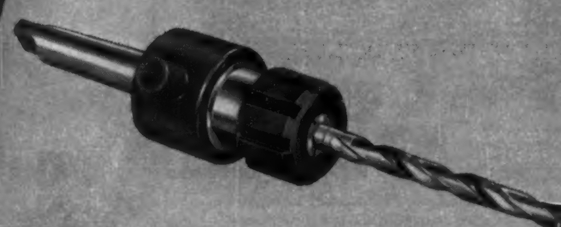


"BUFFALO" UNIVERSAL IRON WORKER — These construction details clearly show you why the "Buffalo" Universal Iron Worker does more jobs, does them better, faster, and lasts longer.



UNIVERSAL BORING CHUCK is heavy and rigid for all types of rough boring without chatter yet accuracy of adjustment adapts it equally well to finish boring. Time-tested Universal Collet nose holds boring tool much more rigidly and securely than set screws while precision and extreme accuracy of feed-adjustment are obtained by an anti-backlash arrangement of feed screw and large dial.

UNIVERSAL RELEASING TAP CHUCK has same basic collet principle featured in all Universal Collet Chucks. Screws or sleeves are not needed and collets are interchangeable with other Universal chucks. Simple, compact design has no springs, cams or pawls to break or wear. Can be used for either right or left hand tapping without adjustment.



HIGH PRESSURE REVOLVING COOLANT TRANSFER CHUCK has standard Universal Collet Chuck nose and a variety of shank sizes can be held by simply changing collets. Minimum overhang is made possible by the single face seal design. Back pressure principle of this design prevents "brake" action thus lowering torque on spindles. Chucks for higher speed and pressures than standard plus a variety of mountings are also available.

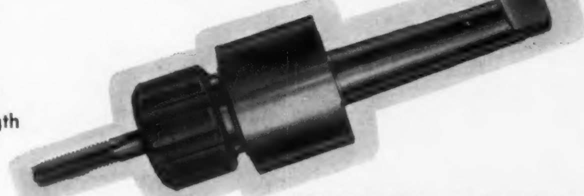
210

UNIVERSAL

COLLET CHUCKS

combine maximum holding power and minimum run out with simplicity of design and low price

The basic collet principle is the same in all Universal chucks. Tools gripped in these chucks withstand a maximum thrust and radial load because the collet grips on a continuous surface its full length and positively locks the tool. Write today for new catalog showing the complete line of Universal collets and chucks.



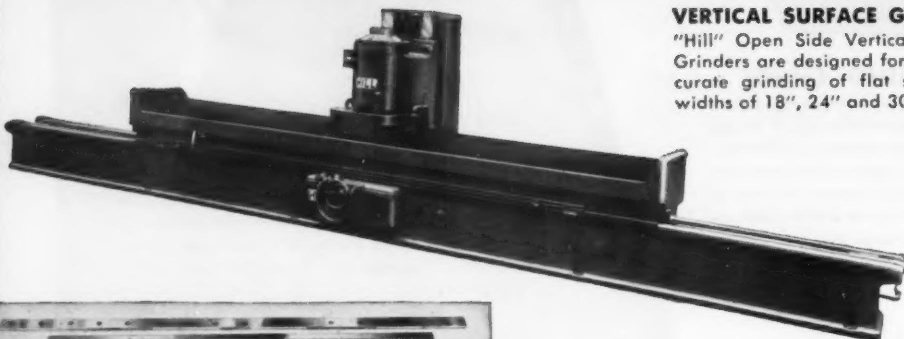
UNIVERSAL FLOATING COLLET CHUCK for horizontal or vertical operation is positively protected against destructive action of coolant by a seal which prevents entrance of compounds into interior of assembly. Frictionless ball bearing flat springs are adjustable to counter-balance weight of the tool.

UNIVERSAL ENGINEERING COMPANY

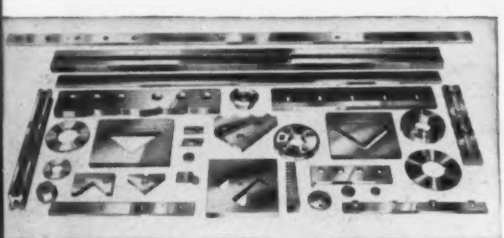
FRANKENMUTH 2, MICHIGAN

HILL ACME

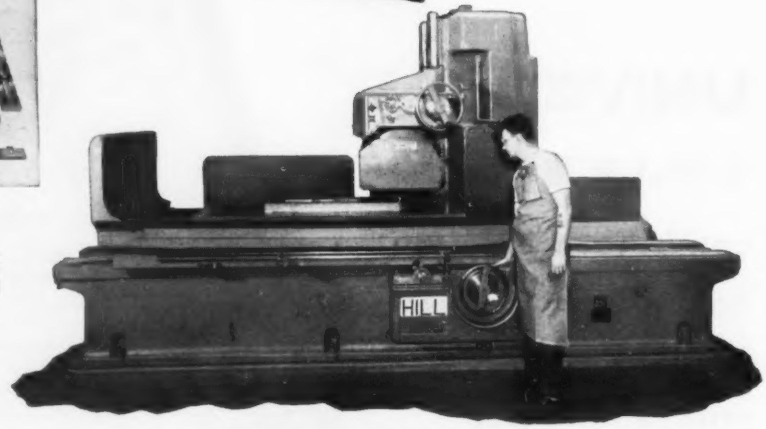
HILL ACME TOOLS FOR INDUSTRY



VERTICAL SURFACE GRINDERS
"Hill" Open Side Vertical Spindle Hydraulic Surface Grinders are designed for rapid stock removal and accurate grinding of flat surfaces. Furnished in table widths of 18", 24" and 30"; table lengths 60" to 240".



SHEAR KNIVES
"CLEVELAND" Knives and Shear Blades, Solid and laid steel shear blades; rotary slitting and side trimming knives; metal cutting machine knives.

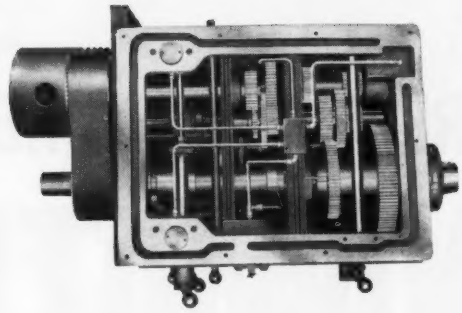


HORIZONTAL SURFACE GRINDERS
"Hill" Open Side Horizontal Spindle Hydraulic Surface Grinders for accurate grinding of flats, angles, irregular and special shaped surfaces. Furnished in table widths from 18" up to 36"; table lengths 60" to 240".

ABRASIVE BELT GRINDING & POLISHING MACHINE
(Pinch Roll Type)
For pre-finishing, conditioning and polishing sheets, plates, strips or blanked-out shapes in flat form. Used as single units or in multiple units for progressive line polishing.

ABRASIVE BELT POLISHING MACHINE
(Hydraulic Table Type)
For flat polishing of sheets and plates of ferrous and non-ferrous metals. Made in a variety of table widths and lengths with fully hydraulic reciprocating table.

The basic HILL two-roll vertical head with endless abrasive belt. Used in both the Pinch-Roll and the Hydraulic Table types.



combination gear-belt headstock

The headstock of the new LeBlond 13″ Precision Toolroom Lathe incorporates combination gear-belt drive, delivers 27 speeds ranging from 18 to 2250 rpm. A timing-type non-slip belt is used for the nine high speeds; lower speeds are gear-driven. A color index plate makes speed selection easy for the operator. A constant speed motor supplies up to 20 h.p. to the gear train through an electric clutch and brake (standard equipment).

adjustments for starting, stopping, jogging

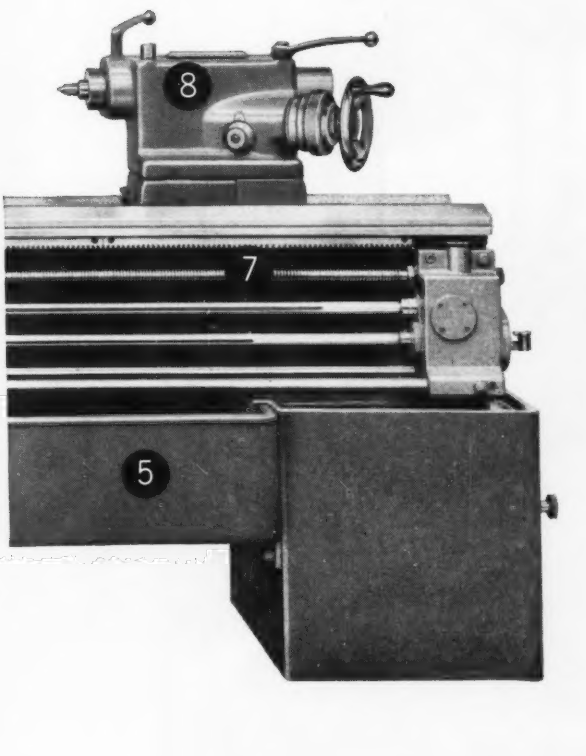
Heavy work pieces are brought up to speed safely with rheostatic controls to the electric clutch and brake. Torque applied for the first six seconds is adjustable to any percentage of full torque. Similar adjustments for stopping and jogging.

new

toolroom lathe

high-speed spindle mounting

Front and center bearings are Timkens in cone-adjusted mountings. The center bearing cup is mounted in a special high speed precision adapter which relieves potential excessive preload—resulting from the inevitable heat of high-speed operation. Front and center mountings are thrust bearings. The original factory-set preload can handle both high and low speeds—no need to reset bearing adjustments in the field.



spur gear design

Minimizes no-load horsepower. Only gears for a specific speed are engaged. Spur gears are fine pitched and wide to give better tooth action and great load carrying capacity. Short, heavy shafts minimize deflection, are mounted on anti-friction bearings. Spindle is completely ground, nose is hardened. Taper nose key drive is positive, simplifies set-up. Provision for multiple-start threads is made with a large easy-to-read dial at the rear of the spindle. A forced feed system lubricates every moving part in the headstock with filtered oil.

other models available

In addition to the new 13″ Toolroom, a new 13″ LeBlond Heavy Duty Lathe is also available. Both can be obtained in plain bed gap models. See your LeBlond Distributor or write today for complete details. Ask for Bulletin T-103D (toolroom) or Bulletin HD-103D (heavy duty).

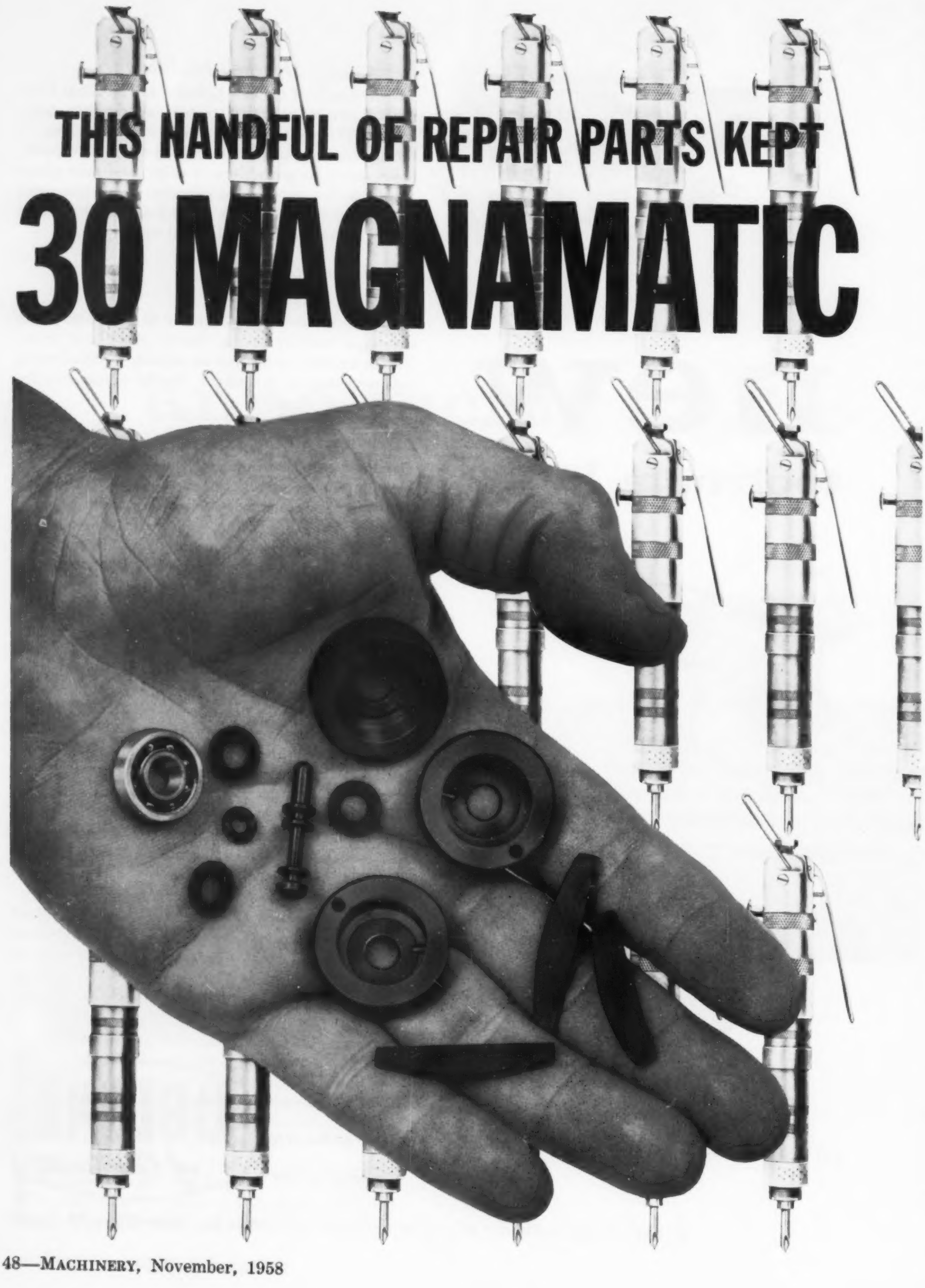
...cut with confidence

THE R. K. LeBLOND MACHINE TOOL COMPANY

Cincinnati 8, Ohio

LeBLOND of Cincinnati

World's Largest Builder of a Complete Line of Lathes for More Than 71 Years


THIS HANDFUL OF REPAIR PARTS KEPT
30 MAGNAMATIC

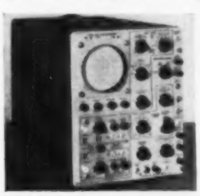
SCREWDRIVERS

ON THE GO FOR A YEAR!

Yearly maintenance records at Tektronix reveal that 30 CP Magnamatic Screwdrivers have been kept in operation at an average repair cost of only *five cents per tool per month.* A perfect combination of low cost performance and high level precision.

In one assembly operation, ceramic terminal strips are attached to the oscilloscope chassis with #2 studs and nuts ...any overdriving would shear these small studs, causing the scrapping of an expensive part. Tektronix also uses the CP Magnamatic Screwdrivers in other assembly operations where any ratcheting would slow down production.

Magnamatic's "One-Shot" Clutch runs nuts to a precise, pre-set torque—completely prevents the ratcheting and over tightening that could tie up production and pile up rejects. And the exclusive Magnamatic muffling principle keeps noise level to a *hush* and production humming even under elbow-to-elbow assembly conditions. For an on-the-spot demonstration or the complete Magnamatic story—tear out coupon and mail right now.



The Type 535 Oscilloscope is one of the precision instruments assembled with CP Magnamatics.

One-Shot Clutch "shifts to neutral" at precise torque—makes every operator an expert. Uniformity of Magnamatic's precision-tightening action is a final quality inspection in itself.

Use the coupon below for more information

Chicago Pneumatic Tool Company, Dept. M- 4
8 East 44th Street, New York 17, N. Y.

☐ Please arrange demonstration. No obligation, of course!

☐ Please send me FREE booklet SP-3165 "Magnamatic Case Histories."

☐ Please send me FREE Bulletin 580 on "Magnamatic" units for multiple applications.

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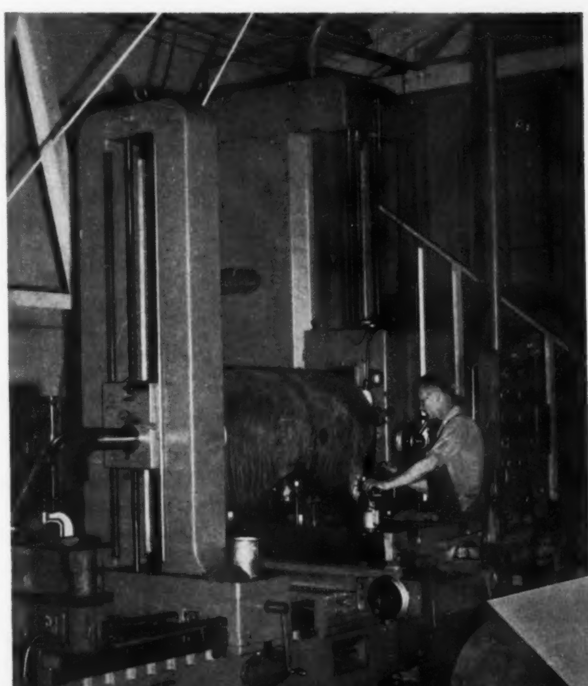
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

"To meet Today's and Tomorrow's Complex Machining Problems

we bought a . . .
BULLARD
H.B.M. model 75"

This statement by Mr. Reed Clark, General Manager, C. & H. Machine and Engineering Company, Berkeley, California summarizes, after thoroughly investigating and comparing competitive machines, their conclusion.



If you are planning to purchase a horizontal boring machine, we invite you to compare, feature for feature, the Bullard H.B.M., Model 75 with other machines in its field. You will discover that — "To Cut Costs When Cutting Metal — Buy Bullard" — is sound advice.

A call to your Bullard Sales Representative or Distributor will bring you the complete story.

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quality in
multiple purpose
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equipment..... ..three
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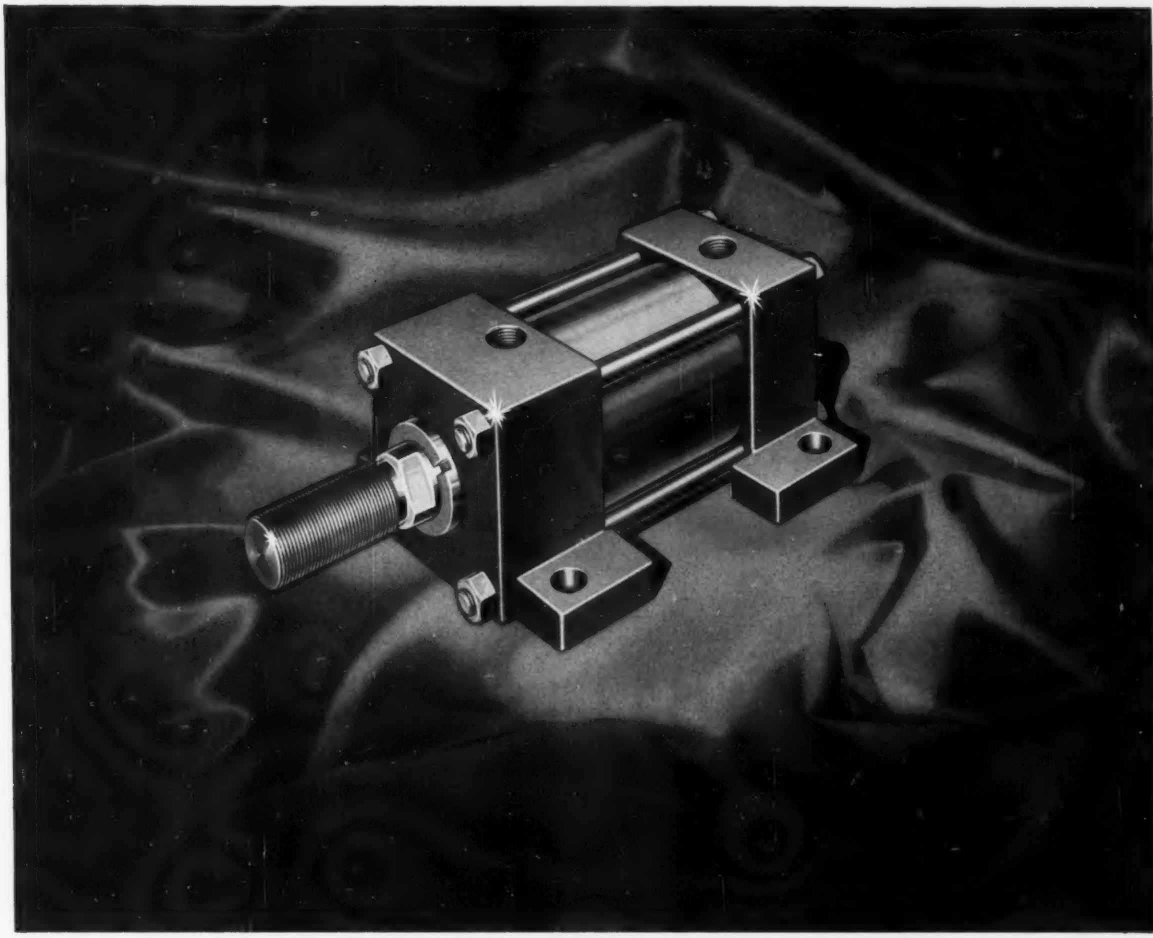

Illustrated—Logan Super-Matic Cylinder Meets J.I.C. Standards

Look to Logan

the ultimate in hydraulic cylinder design

FREE SEND FOR THE "LOGAN CALCULATOR"

MEMBER: Natl. Mach. Tool Builders' Assn.; Natl. Fluid Power Assn.

LOGANSPORT MACHINE CO., INC.
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- ☐ 100-1 AIR CYLINDERS
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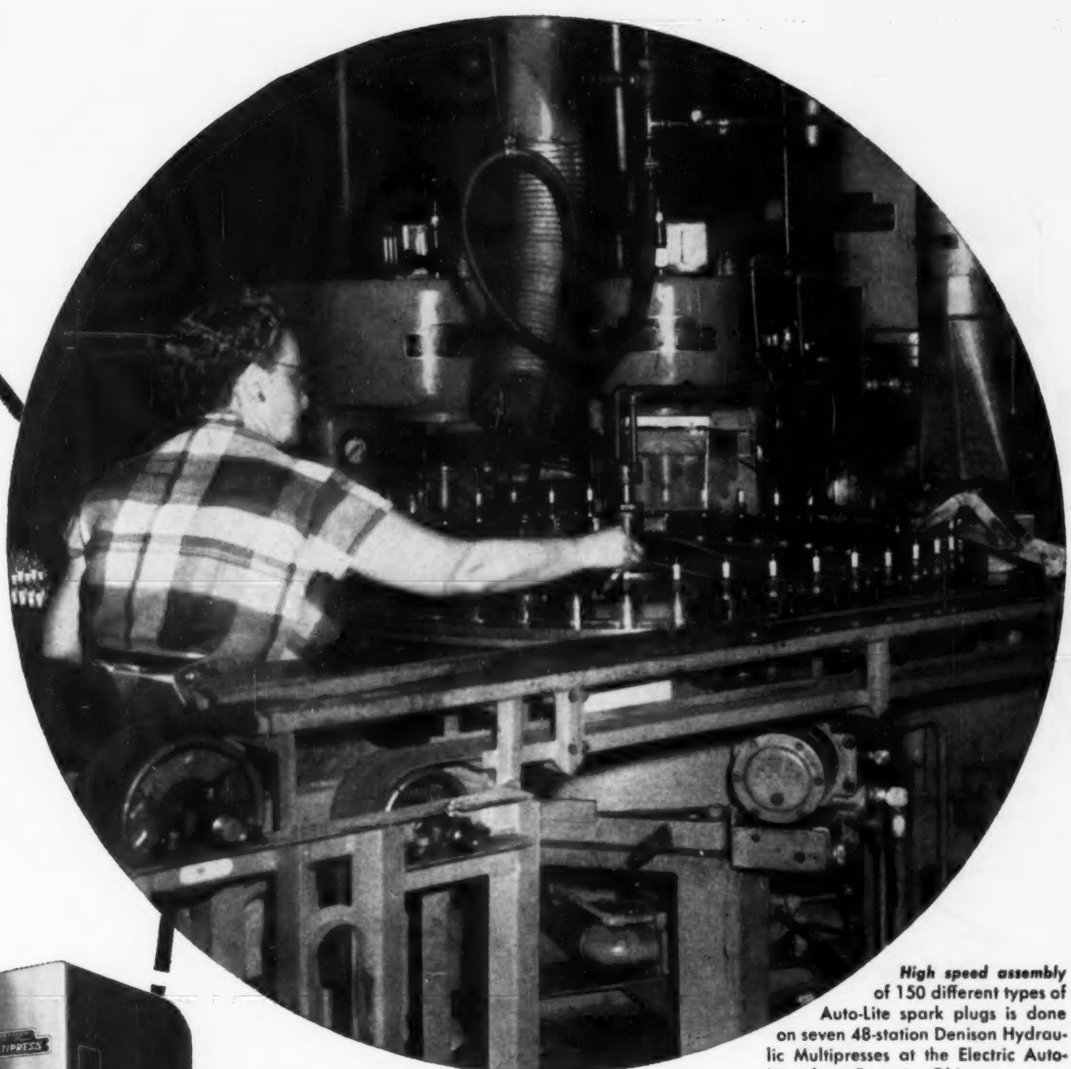

High speed assembly of 150 different types of Auto-Lite spark plugs is done on seven 48-station Denison Hydraulic Multipresses at the Electric Auto-Lite plant, Fostoria. Ohio.

75-TON CAPACITY MULTIPRESS

Series Q Floor model

- 30" daylight—15" stroke
- Closing speeds up to 210 ipm
- Pressing speeds up to 110 ipm
- Return speeds up to 220 ipm

MAIL THIS FORM TODAY!

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1152 Dublin Road, Columbus 16, Ohio

Yes, please send me – at no cost or obligation – more information about the Denison Hydraulic Multipress applications checked below:

Type of Operation		Type of Material	
	☐ Assembling		☐ Steel
	☐ Marking		☐ Brass
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Please have a salesman call ☐

Company Name ______
Address ______
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HOW CAN THE MULTIPRESS HELP YOU?

Use this handy form to get more information

DENISON HydrOILics

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HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

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How fast do you want to drill...

10,000 RPM
MAYBE
15,000 OR 20,000?

Fixed center oil-circulating multiple spindle head with vertical adjustment spindles.

U. S. Drill Heads are designed to provide the fastest drilling speeds that may be required—and to maintain their accuracy over long-run production. Take the Fixed Center Head shown—a close-center, oil-circulating model with full ball bearing design and its own built-in oil pump: this 7-spindle model operates regularly in production at 15,000 rpm with very little heat! Rugged, too! It is built with more reserve stamina than you'll ever need. And as in all U. S. Heads, shaved gears assure quiet, smooth operation—at all speeds.

Write for catalog FC-57 showing a full size range of standard and special fixed center multiple spindle drilling heads and individual lead screw tapping heads.

We manufacture all types of adjustable and fixed center drilling heads, and individual lead screw tapping heads. Ask us to help solve your multiple hole problems.

US DRILL HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

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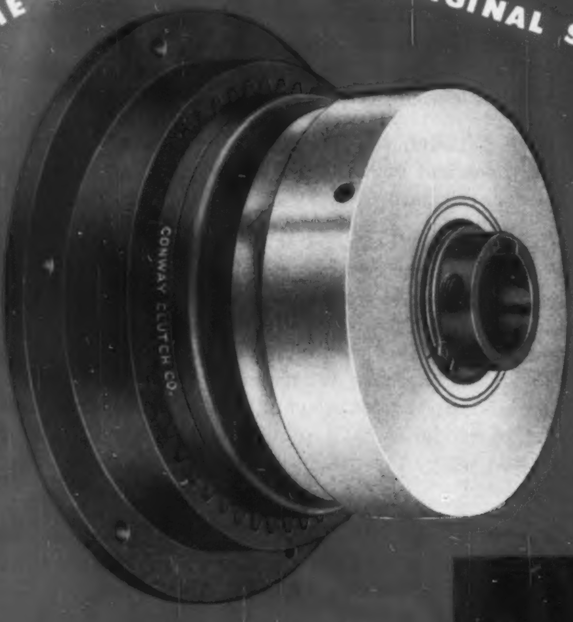
Announcing a revolutionary step forward . . .

Stationaire

by CONWAY

THE CLUTCH WITH THE ORIGINAL STATIONARY AIR HOUSING

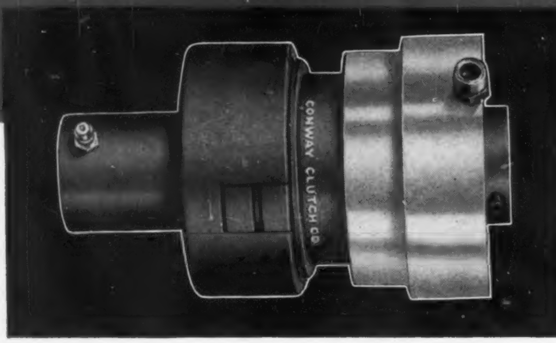


successfully anticipates and satisfies the urgent demand by industry for economical power transmission by providing

POWER

by Conway

THROUGH AIR



Stationaire

offers all the better features of air clutches PLUS these exclusive Conway features:

Stationary air housing . . . no rotating union needed . . . no shaft drilling . . . mount anywhere along shaft . . . just slide on . . . can be used as double clutch . . . complete interchangeability . . . one-piece construction . . . available as couplings and many others.

● ***WRITE FOR BULLETIN 858***

The CONWAY CLUTCH COMPANY

2752 COLERAIN AVE. CINCINNATI 25, OHIO

Pat. Applied-for U.S.A. and Canada

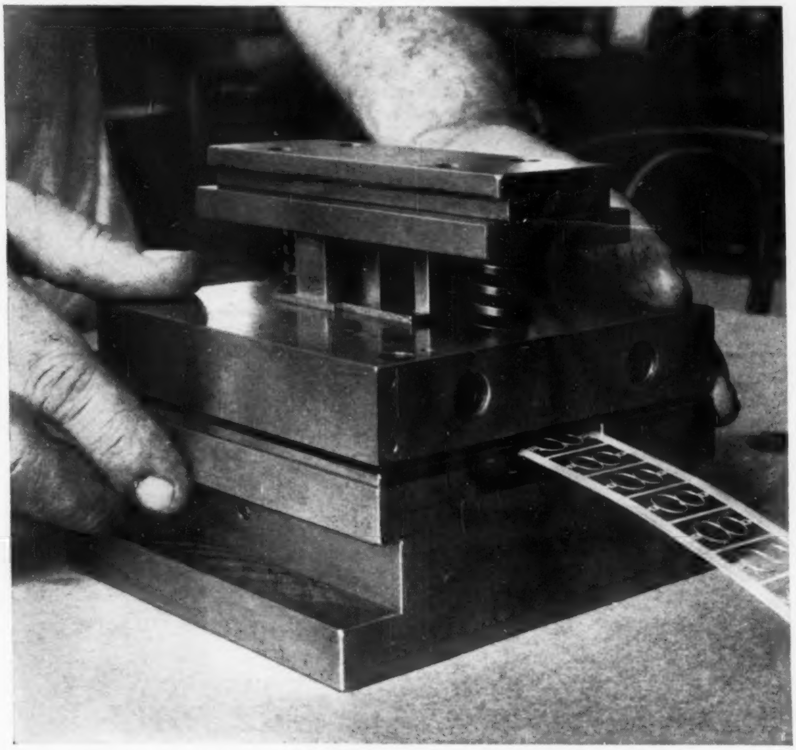
Tool Steel Topics

BETHLEHEM STEEL

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Die of Lehigh H Stamps Delicate Digits

The slim, digit-shaped stampings shown above are anodes, one of a series from 0 to 9, for a numerical indicator tube used in an electronic computer. They are made from several different metals. The width of the anode varies with each digit, and some are as narrow as 0.007 in.

Because of the extremely small clearances involved, the die maker, Be Cu Mfg. Co., Newark, N. J., decided to use progressive dies of a type previously used in producing sub-miniature parts. The dies were made from Bethlehem Lehigh H, supplied by our local tool steel distributor, Lindquist Steels, Inc., Elizabeth, N. J. And because of its low distortional characteristics, Lehigh H proved to be a wise choice.

TYPICAL ANALYSIS

Carbon 1.55	Chromium 11.50
Manganese 0.40	Vanadium 0.90
Molybdenum 0.80	

Lehigh H is our high-carbon, high-chrome grade of air-hardening tool steel. Outstanding because of its minimum size change during heat-treatment, it has the high wear-resistance needed for long-run jobs. Your Bethlehem tool steel distributor has it in stock. Give him a call today.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Heat-Treatment Is SO Important

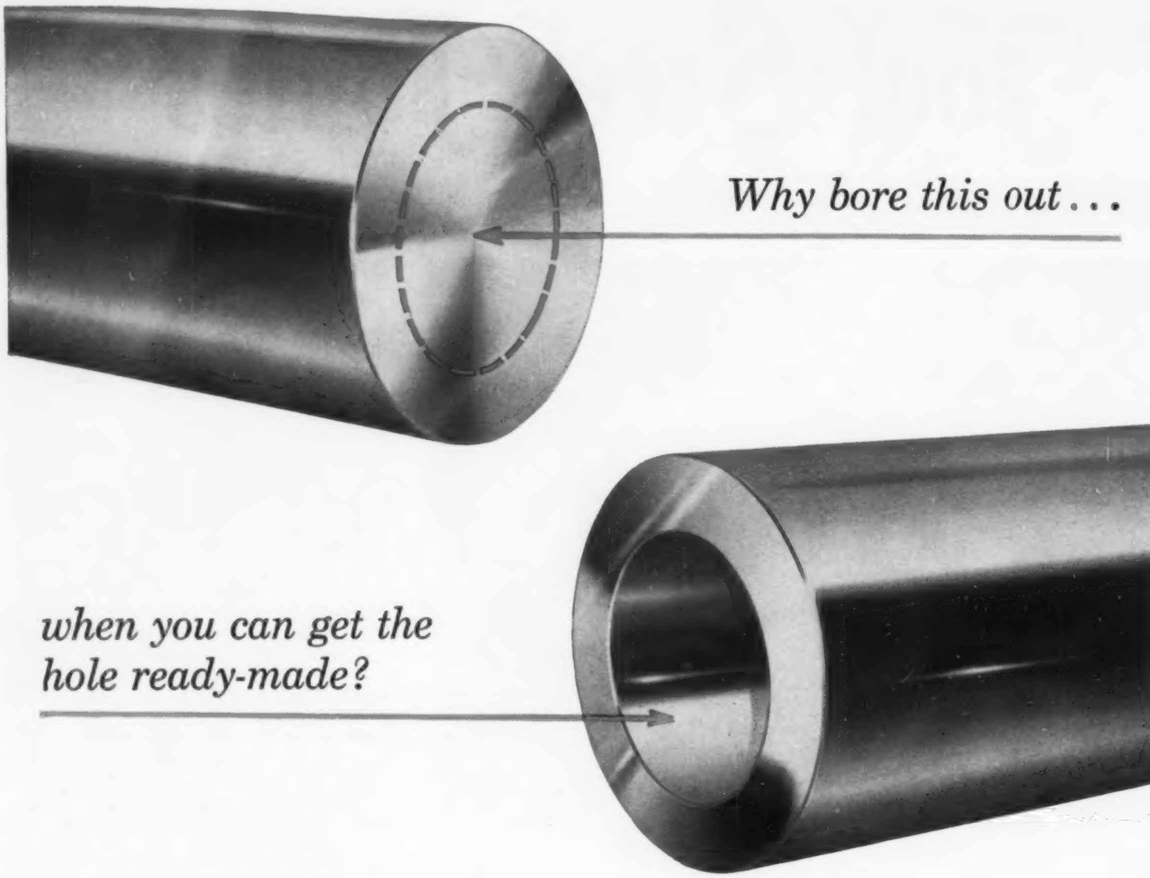
Investigations of tool failures have shown that improper heat-treatment is responsible for a large proportion of the troubles. Adequate heat-treating equipment is often unavailable, or the equipment is operated improperly.

The importance of proper heat-treatment is often overlooked because it is relatively inexpensive as compared with the cost of the steel and the machining operations. However, just as the links in a chain must be equally strong, the heat-treatment operations on tools must be given proper consideration.

Whenever there is any doubt as to the adequacy of available equipment or its operation, it pays to look for help elsewhere. Commercial heat-treating shops, which are located in every section of the country, have the equipment, the ability, and above all, the experience to handle the heat-treatment of tools.

HOLLOW-BAR MINIMIZES MACHINING COSTS

Yes, you get greater economy in the shop, and a saving in material as well, when you use Bethlehem Hollow-Bar tool steel for any part requiring a center hole in the steel. We make Hollow-Bar by high-speed trepanning, which means coring out hammer-forged or hot-rolled bars, then rough-turning them on the outside. You can put the steel right to work, because the hole is already there. Two grades to choose from: BTR (Bethlehem Tool Room, oil hardening), and Lehigh H (high carbon, high chrome).



Save money on hollow parts by switching from bar stock to TIMKEN® seamless steel tubing

Check these savings you get when you make hollow parts with Timken® seamless steel tubing instead of bar stock:

1. **NO HOLE TO DRILL**—it's already there.

2. **ELIMINATION OF COSTLY BORING OPERATION** frees part of your screw machines for other jobs—adds machining capacity *without* adding machines.

3. **MORE PARTS PER TON OF STEEL** because there's less metal to hog out.

And with Timken seamless steel tubing you get better quality finished products. The piercing operation by which Timken seamless steel tubing is made gives the tubing its fine forged quality. A solid round is forged over a mandrel, thoroughly working the metal inside and out. Accurate temperature and piercing speed control combine to produce uniform, fine forged quality. And we maintain this quality from tube to tube, heat to heat, order to order.

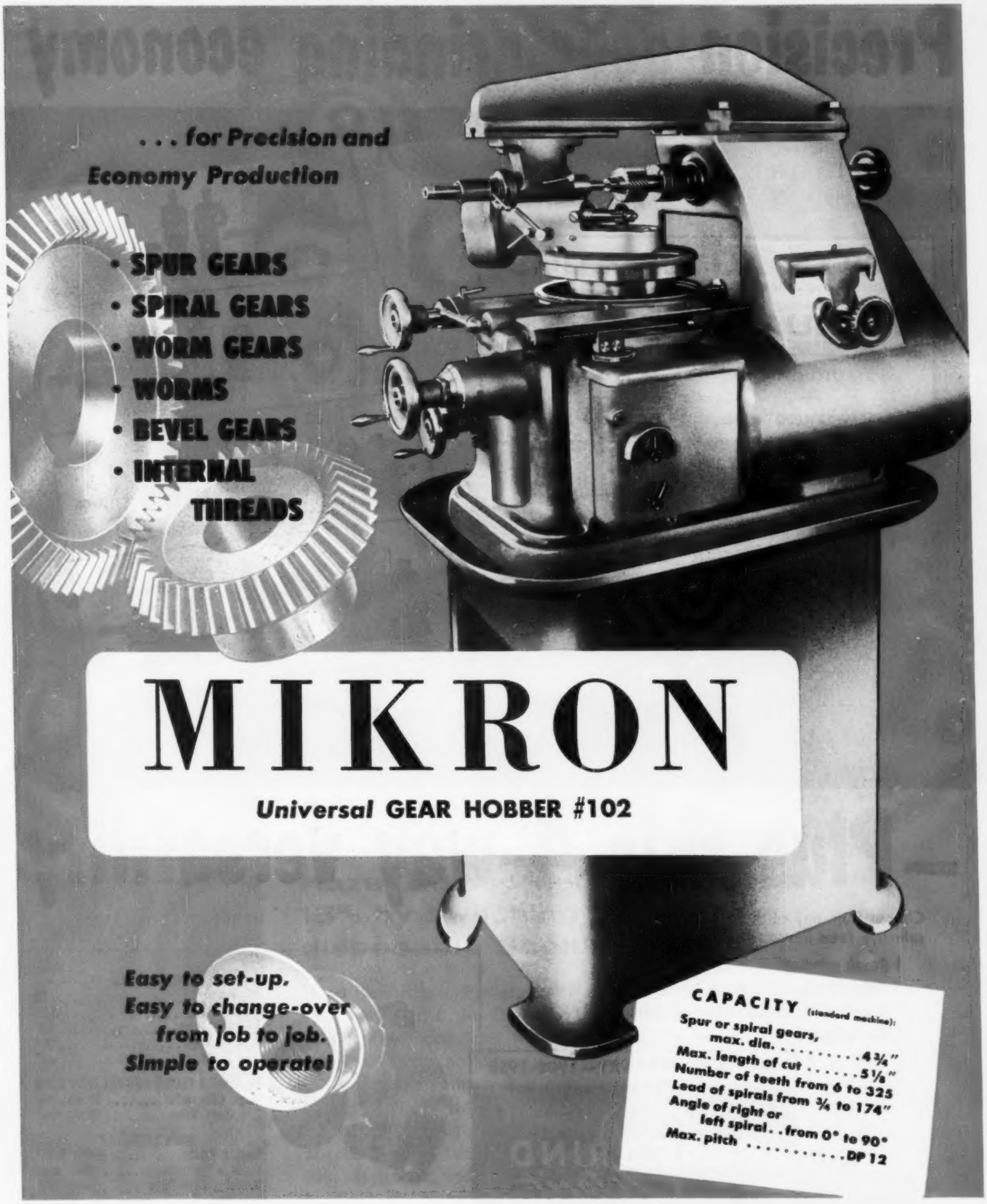
Timken Company engineers are always ready to study your problems, recommend the most economical tube size for your hollow parts job—a size guaranteed to clean up to your dimensions. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U. S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

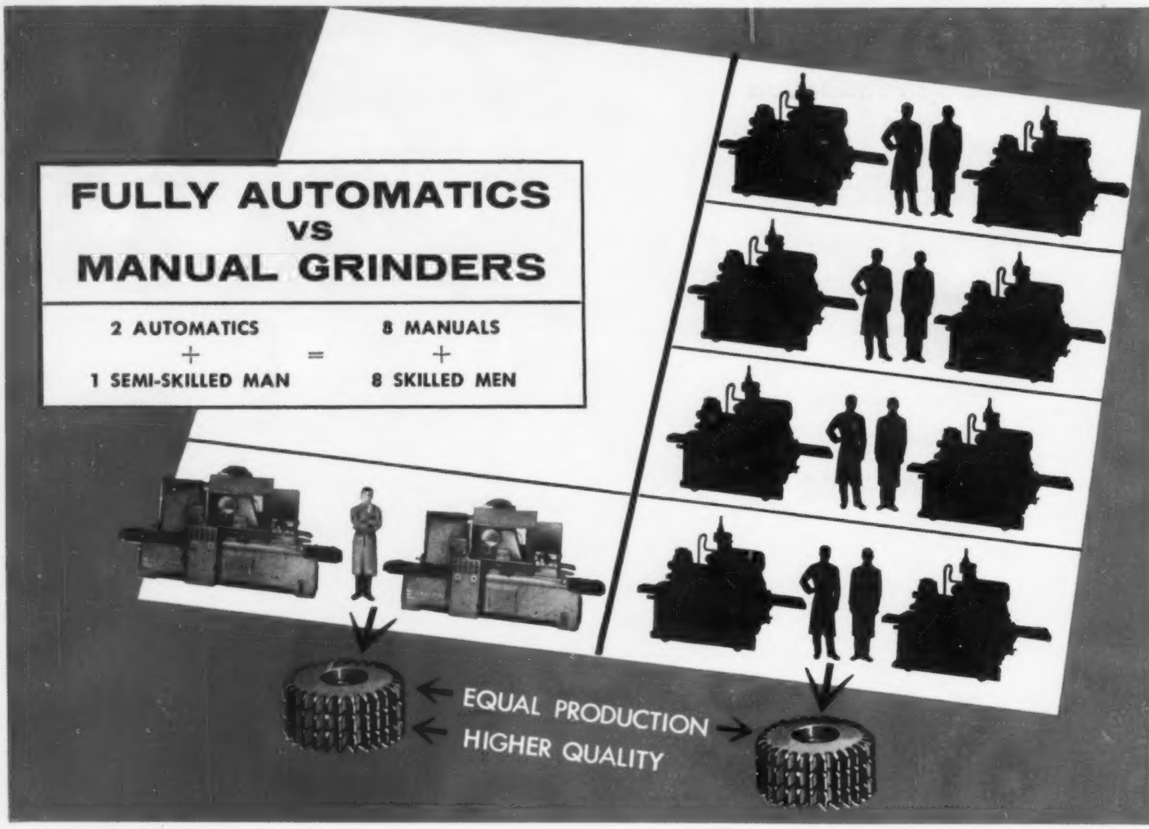
A New Lucas Lathe
Fully-automatic Tape Control, Tracer Control or both. Infinitely variable speeds and feeds. Automatically-maintained, constant-cutting speeds on changing diameters. Console control from moving operator's platform. *Three* hardened and ground ways. Self-contained Motor Generator Set.
The Lucas Lathe — perfect for your large, lightweight, close tolerance, intricately-shaped problem jobs. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.
LUCAS
OF
CLEVELAND



RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

Precision gear grinding economy



—Plus this 4-way versatility

Choose from any of these cycles with selective feed increments:

1. Rough grinding
2. Rough grind; finish grind
3. Rough grind; semi-finish grind; finish grind
4. Manual grind

GEAR DATA

No. Teeth	96
Pitch Diameter	26.7"
Diametral Pitch	3.6
Pressure Angle	25°
Face Width	4.5"

FLOOR TO FLOOR PRODUCTION TIME

Single Gear/Arbor	55 min/gear
Two Gears/Arbor	33 min/gear

GEAR ACCURACY

Involute Profile	Within .0002"
Tooth to Tooth Spacing	.0003" max.
Runout of Pitch Diameter	.0006" total
Lead Error	Less than .0001"/"

50th ANNIVERSARY—1908-1958

GEARGRIND Detroit

UP TO 36" P.D.

For all the facts—write today!

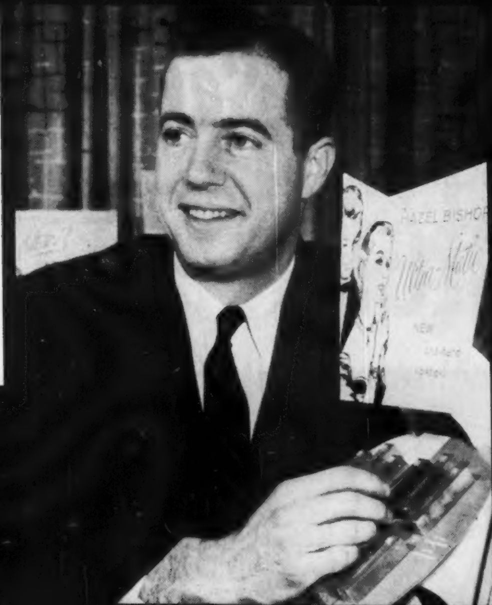
THE GEAR GRINDING MACHINE COMPANY

3921 Christopher, Detroit 11, Michigan

Manufacturers of:

RZEPPA ("Sheppa") Constant Velocity Universal Joints

58-MT5A



Mr. E. M. Goddard reports that Hazel Bishop, Inc. uses Scott Wipers around filling lines, bottle labelers, stapling machines . . . and in the removal of reject labels, lipstick smudges from cases, and condensation from lipstick molds. Employees get boxes of fresh Scott Wipers, keep them right at their work stations.

People buy Scott Wipers for many reasons:

Hazel Bishop cut wiping costs 15% by switching to versatile, disposable Scott Wipers!

Hazel Bishop, Inc., Paramus, New Jersey, has used Scott Wipers for two years. Says Mr. E. M. Goddard, Plant Manager and Purchasing Agent: "We first installed Scott Wipers to give employees a strong, disposable wiper that leaves no lint on filling lines and lipstick assembly lines. Now we use them for machine wiping and many other jobs—and have cut wiping costs at least 15% by switching to Scott Wipers." Advantages: less pilferage, no laundry expenses, simplified in-plant distribution, daily disposal of used Scott Wipers. Mr. Goddard adds that Scott Wipers are soft, easy to use, and are credited with maintaining strict sanitation in the handling of "Hazel Bishop Lasting Nail Polish" and "New Formula Hazel Bishop Long-Lasting Lipstick."

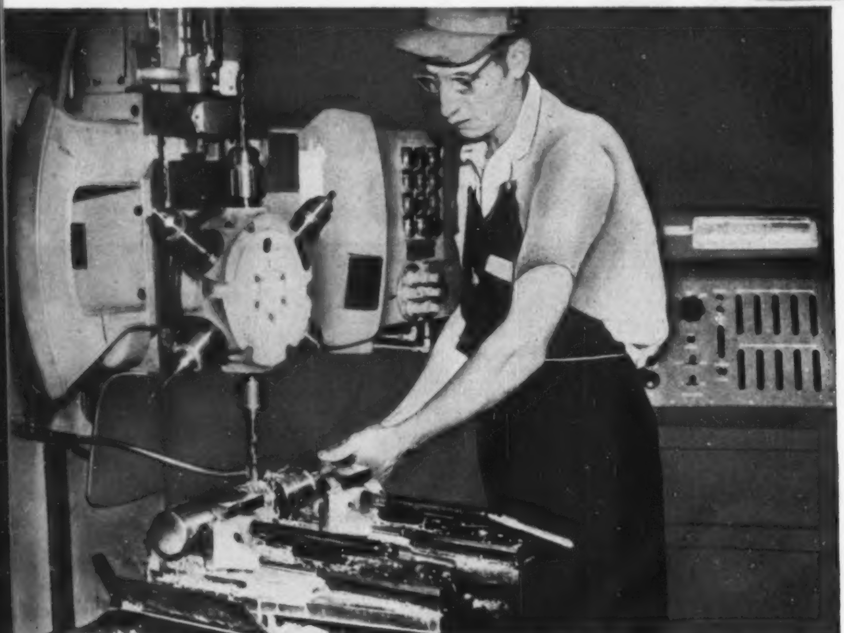
SCOTT PAPER

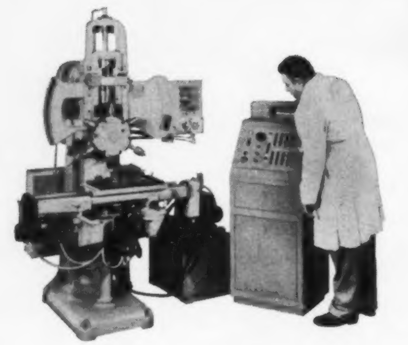
Get the full story from your Scott distributor on Hazel Bishop and many other satisfied users of Scott Wipers. Look in the Yellow Pages under "Paper Towels" or write: Scott Paper Company, Dept. M-811, Chester, Pa.

Maker of the famous Scott paper products you use in your home.
See "Father Knows Best" on CBS-TV.

61% Average Time Savings on 5 Parts;

Burgmaster *tape controlled*





Continuous Position Readout
The Control Display is an electric micrometer which shows, at all times, the actual position of the table to three decimal places and the number of the operation being performed in the machining sequence. The Display reads table positions to +.0000" −.0005"

SIMPLIFIED TAPE PREPARATION

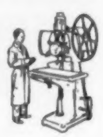
1. Simple hand-punched 10⅝" wide tape. Decimal dimensions and machining sequence data is punched directly into the tape (requiring no special training, codes or computers) at an average rate of one minute per command block. Punched tapes are tooling which can be stored and re-used indefinitely.

2. Flexowriter Typewriter Punched Standard 1"–8 Hole Tape. If desired the system can be provided with standard 1"–8 hole tape control. Tapes can be quickly prepared on a Flexowriter Typewriter, by a girl typist, by typing in decimal coordinates, the spindle sequence, auxiliary functions, etc. Duplicate tapes can be automatically produced from an original punched tape.

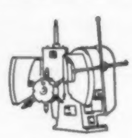
4 Modes of Machine Operation
The Electropoint System provides 4 modes of operation.
1. Manual Control — for set-up, etc.
2. Semi-automatic control — for single parts, etc.
3. Complete automatic tape controlled operation.
4. Standard Burgmaster Automatic Hydraulic Control (Electropoint completely cut out by pressing a button).

Specialists in High Production Turret Drilling

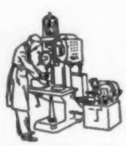
1C Manual Power Index ⅜" Capacity



2B Manual Power Index ¾" Capacity

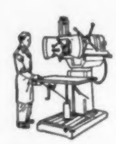


2BF Flange Mounted Power Index ¾" Capacity

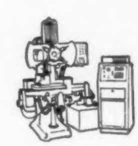


2BH Automatic Hydraulic ¾" Capacity

3BH Automatic Hydraulic 1½" Capacity



2BR Ram Type Radial Drill ¾" Capacity



2BHT—3BHT Automatic Tape Controlled ¾" and 1½" Capacity

$35 Vise Substituted for $400 Fixture

at Jeffrey Manufacturing Co., Columbus, Ohio

Six-Spindle Turret Drill

with *Automatic* Numerically Controlled Positioning Table

Sixty-one per cent average time savings on five parts ranging from 8640 steel to fiber board, using only simple holding vises instead of expensive fixtures to hold close tolerances, is easily accomplished on a Burgmaster Electropoint Six-spindle Turret Drill. The elimination of expensive fixtures greatly reduces the cost per part because many of these parts are produced on a one-time basis.

The 3" diameter 8640 steel coupling pin formerly machined on a vertical drill press in four minutes is now automatically machined in 2.6 minutes. Tolerances of $\pm.001"$ are held and the operator has time during the cycle to burr the parts in four places on a bench drill.

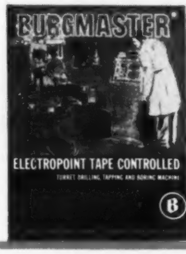
And there are additional advantages:

1. The Automatic Cycle reduces fatigue—and produces consistent accuracy with no scrap loss.
2. Tools run at most efficient preselected speeds and feeds—greatly extends tool life—holds tool cost per piece to a minimum.
3. Quick set-up permits economical machining of small lots—and provides maximum flexibility and versatility.
4. Greatly reduces the number and types of machine tools required to handle a given production.
5. Shortens lead time to put new prints into production—quickly and at minimum expense.

The Burgmaster Electropoint Control System can be applied to either the Model 2BHT—6 spindle or 3BHT—8 spindle Turret Drills, which are machines that are ideally suited for automatic tape control. The standard hydraulic Burgmaster controls are maintained, including pre-selective spindle speeds, infinitely variable pre-selective feeds, selective rapid approach and return, skip indexing, precision depth control, and simple manual controls for set-up. The Electropoint System automatically controls all machine functions, selects spindles in any sequence, automatically positions the table simultaneously on two axes, and clamps it in position while machining operations are being performed. All operations are carried out at their most efficient rate for high finish, precision, speed, and longest tool life.

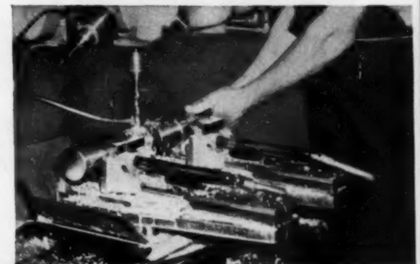
Check into Burgmaster Electropoint Tape Controlled Turret Drilling, Tapping, and Boring Machines for your work. They can save you money from prototype to mass production work. There is a Burg direct representative or dealer near you. Call him—there is no obligation.

Write for Bulletin describing Burgmaster 6 and 8 spindle Electropoint Tape Controlled Turret Drilling, Tapping and Boring Machines. Describes how to program a part, make a punched tape, and put the job on the machine for automatic production. A thirty-minute 16mm sound film showing all Burgmaster Turret Drills in operation is available from any office without charge.



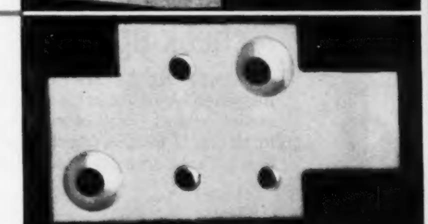
JOB FACTS

PART I: Coupling Pin 3" diameter.
Material: 8640 Cold Finished.
Operations: Drill ½" thru, 2¾" dia. 9/16" in from each end. Burr 4 places on bench drill during automatic drilling cycle.
Former Method: Vertical drill press.
Former Time: 4 minutes.
Present Method: Burgmaster 2BHT Electropoint Automatic Turret Drill.
Present Time: 2.6 minutes.
Savings: 35%—$35 clamps instead of $400 fixture.



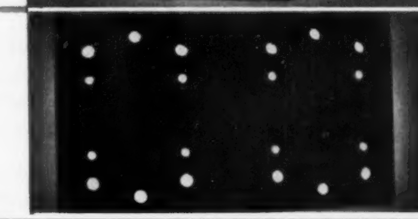
PART II: Arc Shield 3/16"x2⅞"x6⅞"
Material: Asbestos Board.
Operations: Drill 4 holes.
Former Time: 1.2 minutes on drill press.
Present Time: .23 minutes on Burgmaster 2BHT.
Savings: .97 minutes each or 80%.

PART III: Arc Shield Support ⅝"x1⅞"x3 7/16"
Material: Dilicto Grade NC
Operations: Drill 5 holes, counterbore 2 holes, tap 3 holes.
Former Time: 4.8 minutes on drill press.
Present Time: 2.5 minutes on Burgmaster 2BHT
Savings: 2.3 minutes each or 50%.



PART IV: Panel ⅜"x2 9/16"x4⅝"
Material: Vulcoid.
Operations: Drill 7 holes, 3 different diameters.
Former Time: 5.5 minutes on drill press.
Present Time: 1.3 minutes on Burgmaster 2BHT.
Savings: 4.2 minutes each or 76%.

PART V: Base for Fuse ¼"x4"x7"
Material: Fiber Board.
Operations: Drill 20 holes, countersink 8 holes.
Former Time: 7.2 minutes on drill press.
Present Time: 2.8 minutes on Burgmaster 2BHT.
Savings: 4.4 minutes each or 64%.



BURG TOOL
MANUFACTURING COMPANY, INC.
15001 South Figueroa Street, Gardena, California
Tel. FAculty 1-3510, TWX—Compton, California 6011

BURGMASTER DIRECT SALES OFFICES:

NEW JERSEY: BURGMASTER EASTERN SALES DIV., 86 N. Maple, Ridgewood, N. J., Ph. Gl. 4-3002, TWX—Ridgewood, N. J. 724

CHICAGO: BURGMASTER MACHINERY, INC., 5329 Lincoln, Chicago 25, Ill. Ph. Long Beach 1-1178, TWX—CG 3353

CLEVELAND: BURGMASTER OHIO SALES DIV., 14706 Detroit Ave., Cleveland 7, Ohio, Ph. AC 6-3700

DETROIT: BURGMASTER MICHIGAN SALES DIV., 13730 W. 8 Mile Rd., Detroit 37, Mich., LI. 8-4333

SAN FRANCISCO BAY AREA: WALT COOPER, 1341 Old Country Rd., Belmont, Calif., Tel. LYtell 1-0309

Plus dealer representatives in other industrial centers.

check-up:

Art Kent (left), Sinclair Industrial Representative, looks on as shop foreman shows perfect finish of machined part to Mr. H. L. Brasza (right), President of H & L Tool Company, Warren, Michigan.

finished product:

Visor socket for automobiles — one of many products H & L, screw machine specialists, turn out. Machining data: Speed 120 surface feet per minute, feed .004", cycle time 12 seconds.

H & L cuts inventory to one cutting oil...CLAIRO® 16

H & L Tool Company started saving money the day they switched to CLAIRO 16, Sinclair's new Cutting Oil. Head man H. L. (Hank) Brasza says: "CLAIRO 16 did away with the need for several different cutting oils."

"CLAIRO 16 is applied to all H & L machining operations for cutting a variety of steels, including the critical types such as #303 Stainless and AISI-4150. CLAIRO 16 makes it possible for us to machine parts manufactured from AISI-1018 cold rolled bar stock most satisfactorily."

Mr. Brasza continues: "We're also very pleased with the excellent tool life and finish we get with CLAIRO 16."

You, too, can benefit from the advantages of CLAIRO 16 Cutting Oil. Contact your local Sinclair Representative or write for free literature to: Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

SINCLAIR

CUTTING OILS AND COOLANTS

For more data on any products advertised this issue use card, page 189

A-B
QUALITY

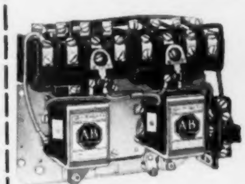
THE ONLY LINE OF D. C. MOTOR STARTERS *with modern* SOLENOID CONTACTORS

With Allen-Bradley, you get D. C. motor control that is *completely modern!* It uses the simplest switching mechanism yet conceived . . . the solenoid contactor with only ONE moving part. There are no bearings to stick . . . no jumpers to break. This assures millions of trouble free operations. And the double break, silver alloy contacts never need maintenance. Available in ratings up through Size 4. Write for details.

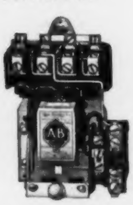
CONTACTORS

Bulletin 202 solenoid type contactor. In ratings to 150 amp. Also, clapper type to 600 amperes.

FULL VOLTAGE STARTERS

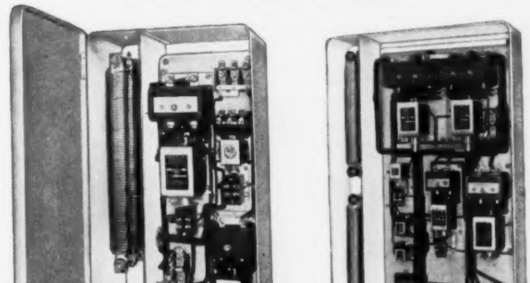


Bulletin 205 full voltage reversing starter. Ratings to 1½ hp, 115 v; 2 hp, 230 v.



Bulletin 209 full voltage starter. Available in ratings up to 1½ hp, 115 v; 2 hp, 230 v.

REDUCED VOLTAGE STARTERS



Bulletin 267 automatic time limit resistor type starters. Nonreversing (left) and reversing (right). Solenoid type to 20 hp, 115 v; 40 hp, 230 v. Clapper to 75 hp, 115 v; 150 hp, 230 v.

11-58-MR

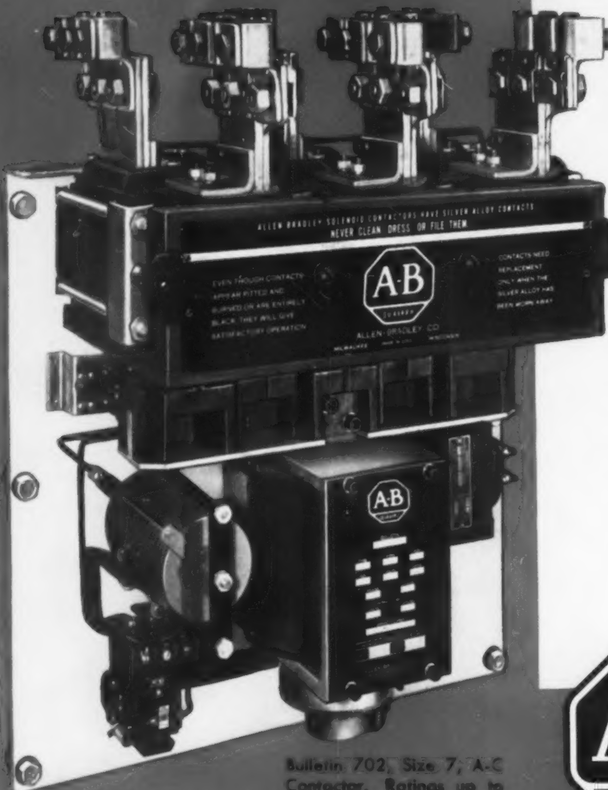
ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

MAIN OFFICE
and Factory
1316 S. Second St.
Milwaukee 4, Wis.

In Canada: Allen-Bradley Canada Ltd., Galt, Ontario

only

ALLEN-BRADLEY gives you Trouble Free Solenoid Starters in *ALL* SIZES!

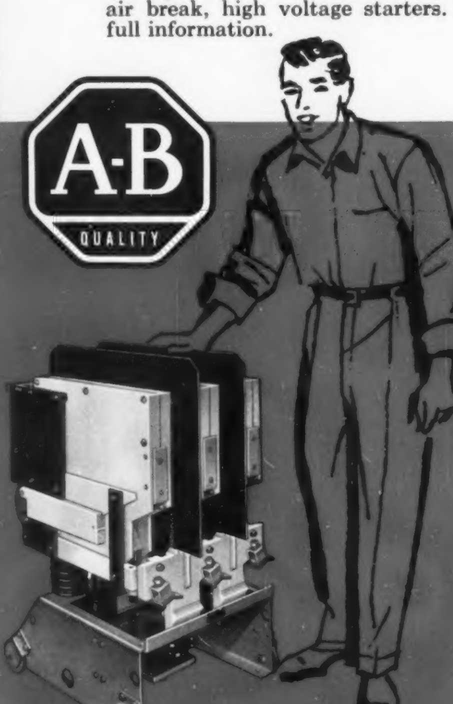


Bulletin 702, Size 7, A-C Contactor. Ratings up to 900 amperes, 600 volts. This basic solenoid contactor is used in large A-B low voltage starters.

The simple solenoid design—exclusive with Allen-Bradley in the big starter sizes—has only one moving part. This eliminates the trouble causing bearings and flexible jumpers of conventional clapper switches . . . and assures millions of trouble free operations. A-B solenoid starters also have double break, silver alloy contacts that never need any servicing. They are always in perfect operating condition—until the contact is completely used up.

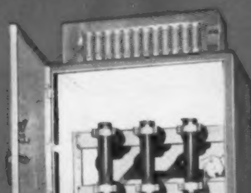
This time-tested solenoid construction is available on *all* Allen-Bradley starters up through Size 7 . . . as well as on A-B's rugged, air break, high voltage starters. Write for full information.

A-B QUALITY



The heart of Allen-Bradley high voltage starters is this air break, solenoid type contactor—rated at 400 amperes, 2300 or 4600 volts.

Bulletin 709 across-the-line solenoid starters are made in ratings to 300 hp, 220 v; 600 hp, 440-550 v.



A-B high voltage starters are built for all types of motors. Ratings to 1500 hp, 2300 v; 2500 hp, 4600 v.

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

11-58-MR

how GREGORY INDUSTRIES *reduces to careful analysis their cost savings opportunities*

RE-EQUIPMENT ANALYSIS AND OPERATIONAL COMPARISON

WORK SHEET — See Summarizing Report and Recommendations (Page 1 of 2). See reverse side for other calculations.

Dated Jan. 3, 1957
Number

Line
1 Subject of Analysis Replacing screw machines with cold heading equipment to make
2 certain Nelson stud welding products
3
4 Assumed rate of production 3,000 pieces per hour

	A — PRESENT EQUIPMENT - DEFENDER	B — PROPOSED EQUIPMENT - CHALLENGER
6A/B	Description Screw Machine	Description [redacted]
7	Machine Number ___ Date Purchased ___	Make and Source [redacted]
8	Location Lorain Installed Cost $ ___	Cost of Unit $ ___ Installation $ ___ Total $ 90,000
9	Disposal 27,000 Salvage or Conversion Value $ 27,000	Estimated Primary Service Life 15 Estimated Terminal Salvage $ 18,000

Line	10 OPERATIONAL NEXT-YEAR ADVANTAGES (DIFFERENCES)	A Defender Total	A Defender Advantage	B Challenger Total	B Challenger Advantage
11	Income Advantages-				
12A/B	Superiority of Product	$	$	$	$
13	Increased Output				
14	Other				
15	Operating Cost Advantages				
16	Direct Labor, Incl. Overtime & Shift Premiums				
17	Set-Up Time				
18	Indirect Labor Set-up	5,278		4,659	619
19	"Fringe" Labor Costs Production cost	139,420		102,720	36,700
20	Ordinary Maintenance Inventory	10,443		8,816	1,627
21	Special Repairs				
22	Tool Costs				
23	Supplies				
24	Defective Material - Rework				
25	Spoilage - Scrap				
26	Downtime - Outage				
27	Power Consumption				
28	Floor Space, if Usable				
29	Property Taxes and Insurance				
30	Sub Contract Costs				
31	Other				
32A/B	Totals	$ 155,141	$	$116,195	$38,946
33	Defender Operating Inferiority (Net Challenger Advantage) 32B — 32A				$38,946

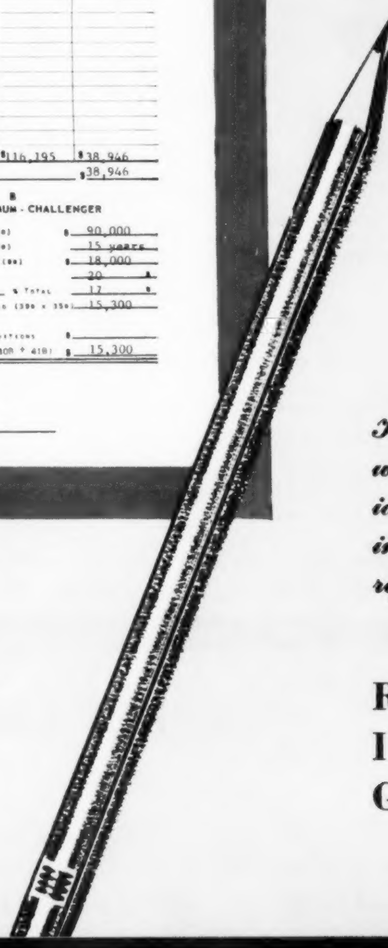
Line	A — 34 ADVERSE MINIMUM - DEFENDER		B — ADVERSE MINIMUM - CHALLENGER	
35	Operating Inferiority (Line 33)	$ 38,900	Cost Installed (Total 8B)	$ 90,000
36	Salvage value loss, next year	$ 0	Primary service life (9B)	15 years
37	Interest @ __ % (x Line 9A)	$ 2,700	Terminal salvage value (9B)	$ 18,000
38	Capital additions, Total $ ___		Salvage % (37B of 35B)	20 %
39	Next year proration	$ 0	Chart ___ % Int. ___ % Total	17 %
40	Interest @ ___ % (x Line 38A)	$ 0	Total % x Cost Installed (39B x 35B)	15,300
41	Total, Omitting Line 38 =		Annual Average, Periodic Capital Additions	$
42	Adverse Minimum	$ 41,600	Adverse Minimum (40B + 41B)	$ 15,300

43 NEXT YEAR GAIN FROM REPLACEMENT (42A – 42B) $ 26,300 *
After income tax 13,650

Analysis by Dominick Ciarrone   Approved G. P. Hopkins

"Gregory Industries, Inc. manufactures Nelson stud welding equipment and granular flux-filled studs which are automatically end welded to metal with the stud welding gun. Employed to hang, handle or hold, Nelson studs are used extensively in the metal working and construction fields to reduce costs, speed production and improve product quality."

George E. Gregory,
President
GREGORY INDUSTRIES, INC.



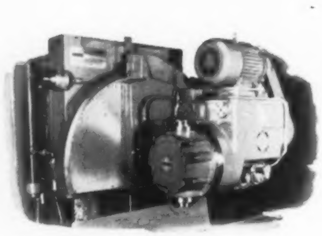
Keep gathering metal-working production ideas . . . be well informed when you replace machinery.

* **GAIN** from replacement under the MAPI method . . . after the return on the new investment . . . after allowance for future obsoelscene of new equipment.

ROCKFORD INSERT GROUP

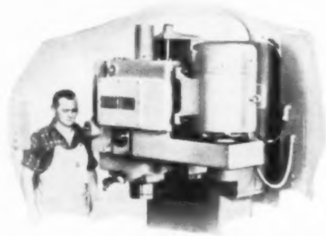
Get the one best milling machine for your job

by starting with elements like these



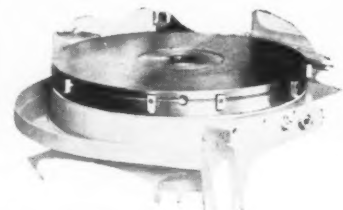
ALL-ANGLE HEADS

In two basic styles and rated up to 30 hp, permit outstanding machining economy by positioning the spindle instead of the work.



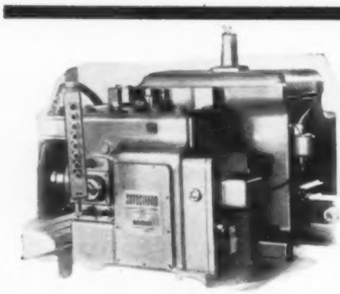
VERTICAL OR HORIZONTAL HEADS

Available in capacities from 3 to 100 hp provide the speeds and horsepowers needed to handle either nonferrous metals or superalloys.



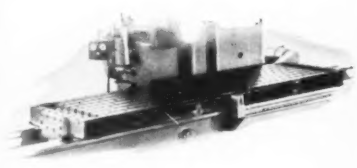
ROTARY TABLES

Are available in a variety of sizes and types for continuous or rotary milling to meet an almost unlimited range of production needs.



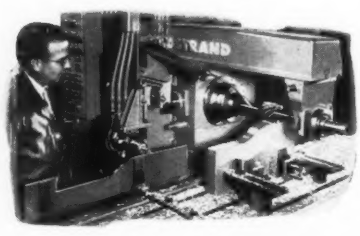
ADJUSTABLE COLUMNS

Provide maximum cutting rigidity for horizontal heads over a wide range for milling both large and small workpieces.



HORIZONTAL TABLES

Available in widths ranging from 10½" to 96" and feed strokes from 18" to 216" permit combining the table sizes and spindle horsepowers that do the job best.



TRACER OR TAPE CONTROL

Basic design elements make it possible for Sundstrand to provide machines with hydraulic tracing for non-ferrous metals, electronic tracing for ferrous metals or tape control for 1 to 5 axis element movement.

It's a basic principle of Sundstrand Rigidmil design to combine standard elements into machines that give custom built performance.

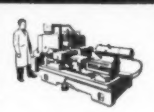
The other important ingredient in putting Sundstrand "Engineered Production" to work on your job is the application of years of manufacturing and machine design experience to your production problems. This know how is behind the determination of the correct tooling for your job and the selection of machine elements needed to complete the machine.

Machines shown on the page at the right are typical of some of the new ideas in milling machines that you get from Sundstrand. From Sundstrand you get precisely the machine you need for the jobs you have to do. No need to compromise quality or performance by buying too little machine — no need to pay for more machine than you need to get the job done.

SUNDSTRAND "Engineered Production Service"*

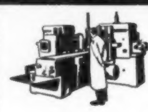
*REG. U.S. PAT. OFF.

AUTOMATIC LATHES

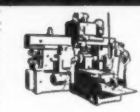


SIMPLEX RIGIDMILS

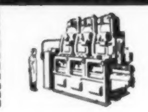
DUPLEX RIGIDMILS



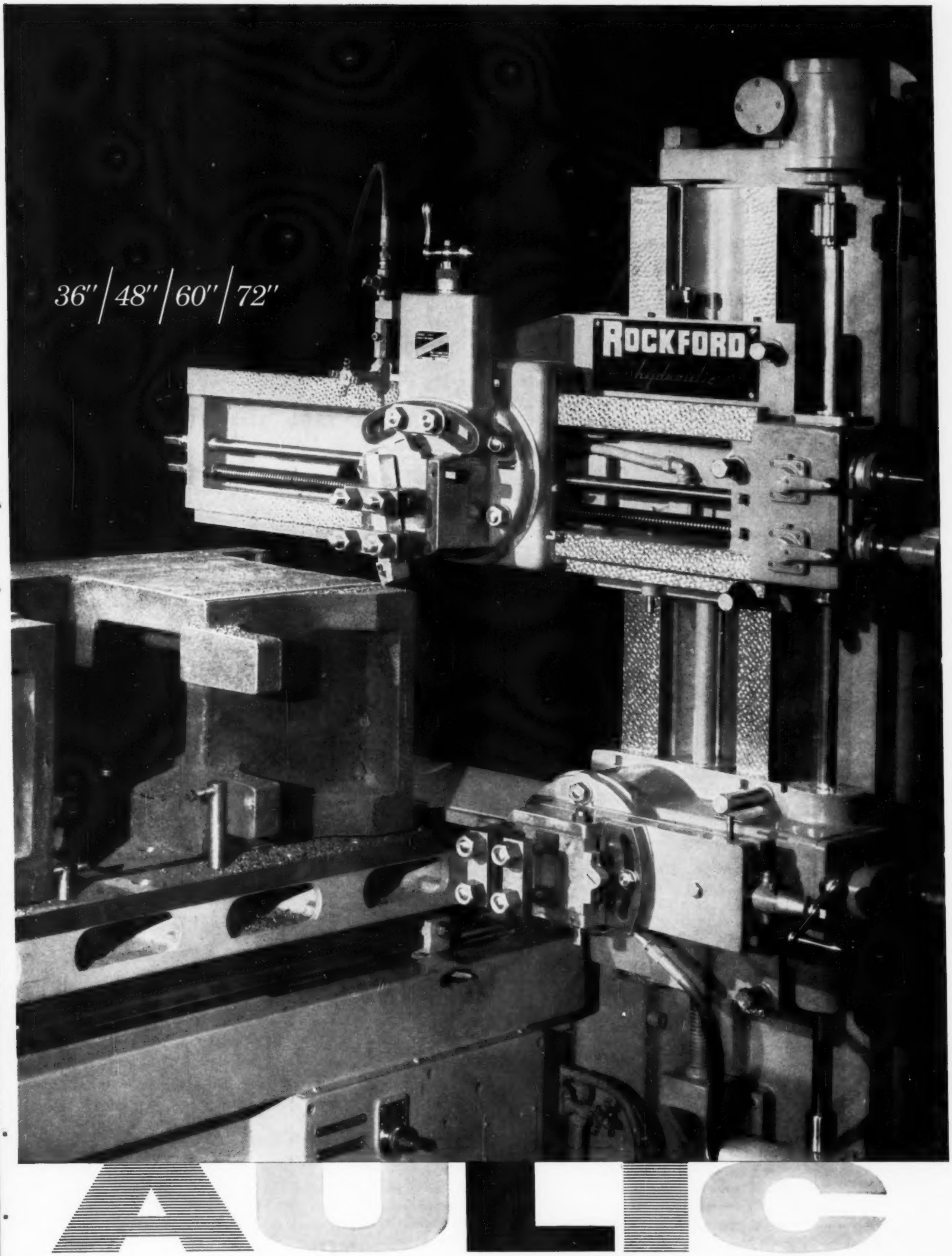
TRIPLEX RIGIDMILS



SPECIAL MACHINES



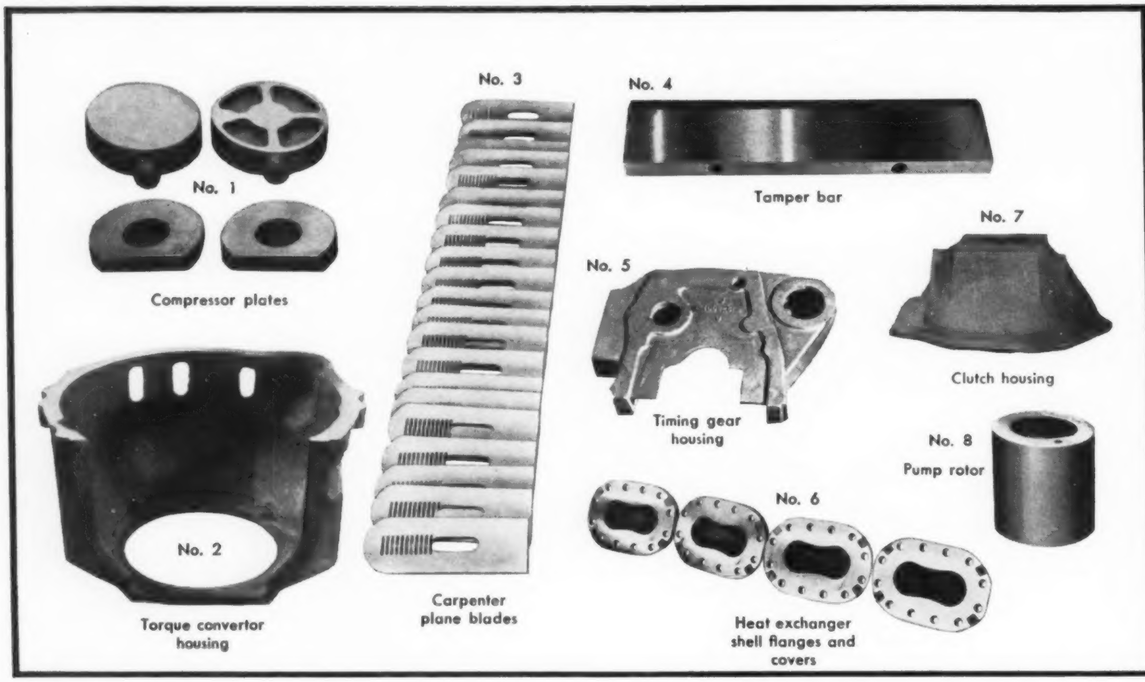
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**


36"/48"/60"/72"
ROCKFORD
AULIC

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

Here are 8 strikingly profitable jobs

... done on standard surface grinders!



Are your profits pegged by machines you bought 20 years ago?

When there's a change in the "economics" between one machining method and another, do your profits change, too?

Or are they pegged by rising costs and fixed productivity of machines you bought 20 years ago! Surface grinding "economics" has been changing fast, partly because of improved grinding wheels, and striking profit improvements have resulted for manufacturers who have re-evaluated conventional methods of 10 or 20 years ago.

Some shops haven't recognized the fact that surface grinding is an efficient and fast stock removal operation. But it is . . . and as such, it gives you a roughing method that combines the advantages of high initial accuracy, easier cutting through outer scale and hard spots, and valuable material savings due to reduced stock allowances. Of significance to you are the resultant opportunities to reduce costs, particularly those associated with the actual cutting of metal, such as downtime for tool changes, tool breakage, tool sharpening, resetting, cutting fluid carry-off, chip disposal, etc.

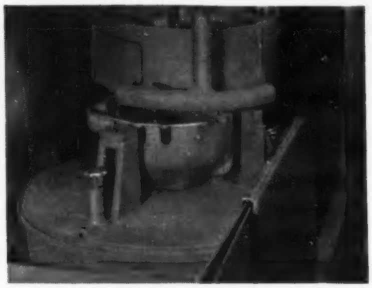
You may not have thought of it this way, but it is important to take into account the fact that a grinding machine *sharpens its own cutters.* By using open-structure wheels which automatically release their grits when they get dull, and with automatic work sizing to compensate for wheel wear, you never have to stop your surface grinder to service the cutting tool. The only perishable tool cost is wheel depreciation per piece. Thus, savings in tool replacement cost alone often pay for a new surface grinder. A glance at the jobs illustrated will show you how.

JOB NO. 1—*High efficiency*

Continuous, single-pass grinding at 4800 surfaces per eight-hour shift on this five-spindle rotary automatic, plus self-dressing wheels and automatic sizing, eliminated nonproductive machine time. Two different cast iron compressor parts are ground from the rough, holding flatness and parallelism within .001 in. Stock removal is .077 in. per side. Former production was only 1200 surfaces per shift.

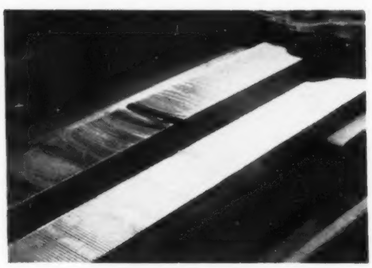
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

JOB NO. 2—*Two operations eliminated*



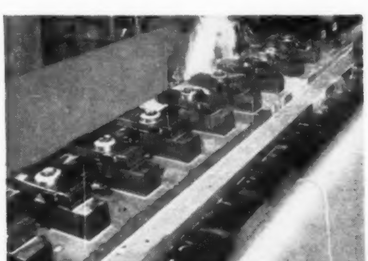
The open section in these torque converter housings made them difficult to mill without springing the ends. Top and bottom surfaces are now being ground from the rough, eliminating two milling operations on each surface. Production is 17.4 pieces per hour. Stock removal is .060 in. to .070 in. per side. Flatness and parallelism are easily held within the .0015 in. tolerance. There's no downtime because wheels are self-dressing and the operator loads one table while the work is being ground on the other.

JOB NO. 3—*Cost reduced four ways*



Striking savings were made possible by reducing setup time from nine hours to ½ hour; machine maintenance was reduced; wheel replacement cost was minimized; and production of hardened steel blades at the rate of 1750 per hour was achieved from four Mattison surface grinders against eight machines formerly required for the same work. Parts are stacked on magnetic chucks. Stock removal is .012 in. per side.

JOB NO. 4—*Production boosted 26%*

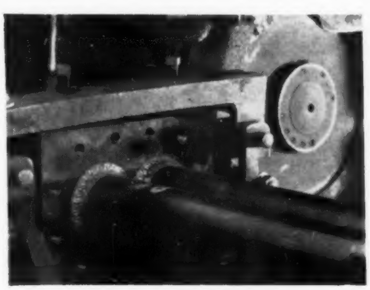


The average production increase for three different grinding operations on heat-treated 52100 (54-57 Rockwell, C) steel tamper bars is 26 per cent over the former method because of larger contact area of the segmental wheel, plus high horsepower of the spindle motor for removing stock efficiently and fast. Rejects have been eliminated because the grinder easily holds flatness within the .005 in. tolerance, and the same consistent performance is obtained whether feeding fine or taking a brute cut. No maintenance has been required since the installation of the Mattison grinder.

JOB NO. 5—*Production rate doubled*

More pieces per table load, faster setup on the magnetic chuck, and high stock removal rate on the vertical-spindle surface grinder boosted production of these timing gear housings from 5 to 12 per hour over milling. Parts are first rough ground to within .010 in. on both sides and then finished on the same machine. This eliminates warpage and increases accuracy.

JOB NO. 6—*$3500 material saved*



A 10 per cent reduction in stock allowances after these heat exchanger shell flanges and covers were switched from milling to grinding produced a saving of $ .228 per part in material cost alone. In addition, one operator now grinds the same amount of production as two men formerly machined on two boring mills. This released one operator and two mills for other work. Carbon steel flanges on the ends of large, awkward tubes can be ground on the same traveling-wheel face grinder that grinds the cast steel covers (held in a two-position rotary fixture). The grinder produces a gasket fit that prevents leakage at tube pressures up to 5,000 psi. Stock removal is 1/16 in., and flatness is held within .003 in.

JOB NO. 7—*Three operations eliminated*

Formerly, the transmission and motor faces of these clutch housings were machined by two grinding and two milling machines. After putting them on a multiple-spindle, single-pass rotary surface grinder, rough and finish machining was combined in one setup, increasing production from 40 to 80 housings per hour. It now takes only 30 minutes to set up the grinder (mostly to change wheel segments) compared with a change-over time of from 1½ to 2 hours on the former equipment. Stock removal is ⅛ in. per side; flatness and parallelism are held within .004 in.

JOB NO. 8—*Assembly speeded*

Parts for scientific apparatus are now being assembled much faster due to increased accuracy of the Mattison horizontal-spindle surface grinder, and production has been increased 100 per cent over the former method. The semi-steel pump rotors shown, for example, are held flat and parallel within .0003 in. Production rate is 50 pieces per hour.

Try before you buy

You can explore these new opportunities to increase profits without spending money. Before you buy, we offer a free evaluation of your work, including a sample grind of parts in the Mattison Methods Laboratory. From this, we will give you a complete job analysis, including wheel consumption, production rate, tooling, accuracy, finish, wheel specifications, coolants, type of machine best adapted to your work, and cost. There's no obligation—phone your Mattison dealer or the factory direct—phone 2-5521

MATTISON
MACHINE WORKS
ROCKFORD ILL. U.S.A.

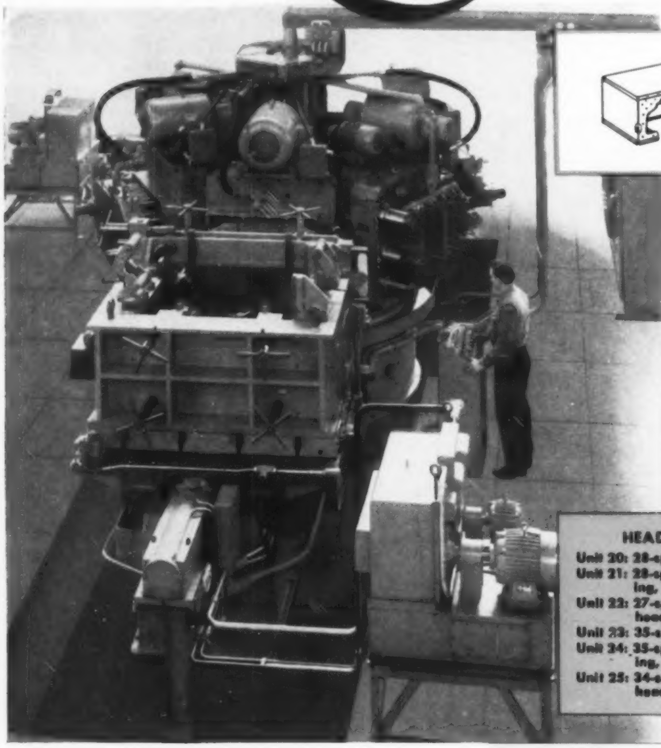
MATTISON MACHINE WORKS
Rockford, Illinois **Phone: 2-5521**

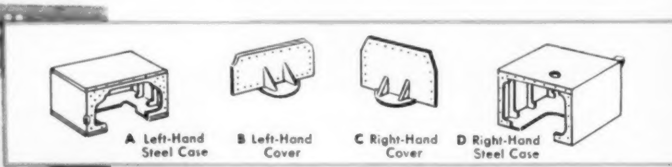
NEW W. F. & JOHN BARNES

STANDARD

Versa-Matics

Patents Pending





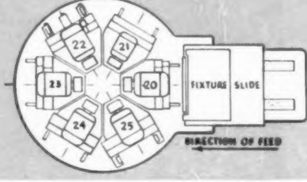
MACHINE No. 1

Standard Barnes "Versa-Matic" with 6-Station Rotary Table and Shuttle-Type Work Holding Fixture. Drills, reams, chamfers, and taps workpieces A, B, C, D, and E.

Approx. Loading Time per piece .... 3.00 min.
Approx. Unloading Time per piece .... 2.00 min.
Gross Production (100% efficiency):
Case Parts .... 6.55 per hr.
Cover Parts .... 9.50 per hr.

HEAD OPERATIONS

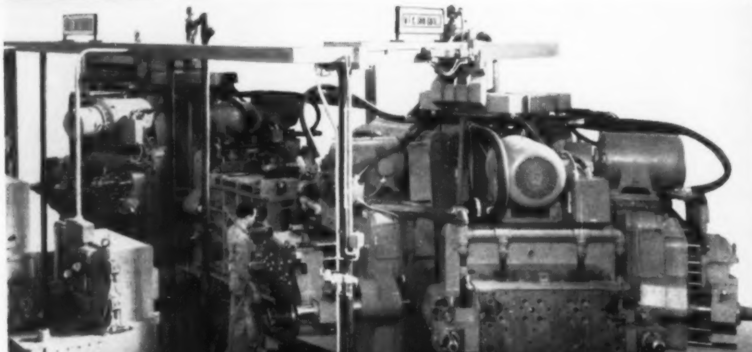
Unit 20: 28-spindle drilling head
Unit 21: 28-spindle chamfering, reaming, & counterboring head.
Unit 22: 27-spindle tapping & milling head
Unit 23: 35-spindle drilling head
Unit 24: 35-spindle chamfering, reaming, & counterboring head
Unit 25: 34-spindle tapping & reaming head

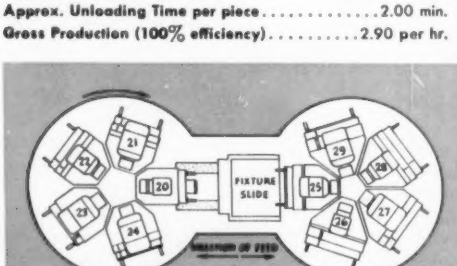


MACHINE No. 2

Standard Barnes "Versa-Matic" with Two Five-Station Rotary Tables and Shuttle-Type Work Holding Fixture. Drills, chamfers, reams, and counterbores different surfaces of same workpieces A, D, and E processed on Machine No. 1.

Approx. Loading Time per piece .... 3.00 min.
Approx. Unloading Time per piece .... 2.00 min.
Gross Production (100% efficiency) .... 2.90 per hr.





HEAD OPERATIONS

LEFT-HAND

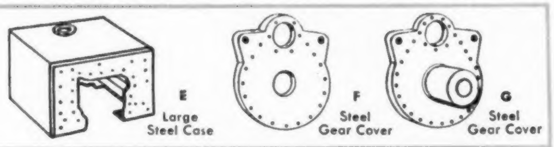
Unit 20: 19-spindle drilling & boring head
Unit 21: 39-spindle drilling head
Unit 22: 52-spindle chamfering, reaming & counter-boring head
Unit 23: 29-spindle tapping head
Unit 24: 24-spindle tapping head

RIGHT-HAND

Unit 25: 17-spindle drilling & counterboring
Unit 26: 22-spindle drilling, reaming, & chamfering head
Unit 27: 28-spindle drilling head
Unit 28: 48-spindle chamfering, reaming, & counter-boring head
Unit 29: 46-spindle tapping head

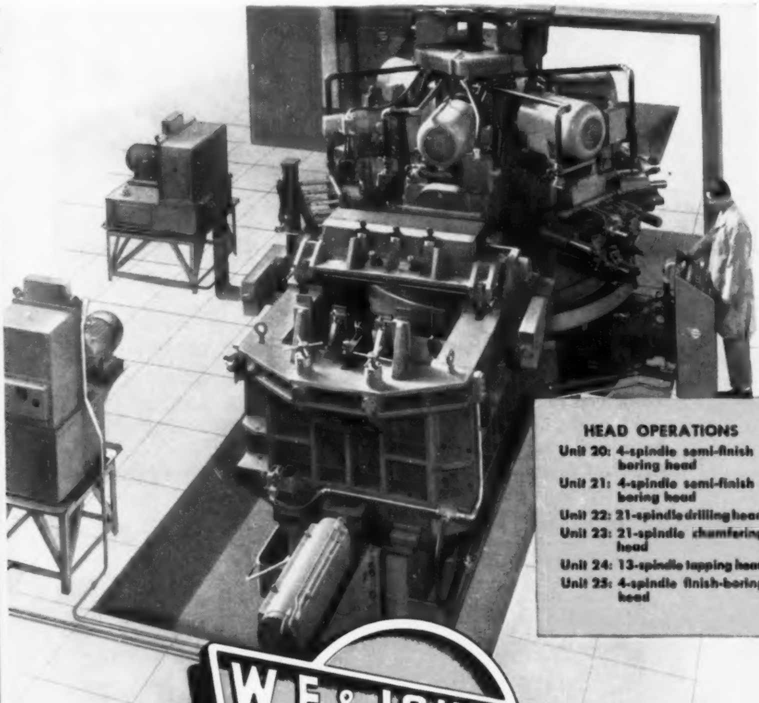
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

NOW OFFER 3-WAY SAVINGS FOR SMALL LOT MACHINING



Versa-Matic Design Assures Greater Efficiency on Low Production, Conserves Capital Expense and Floor Space

These new W. F. & John Barnes production machines, termed "Versa-Matics," illustrate three basic applications incorporating a new, exclusive principle in machine tool engineering which now makes possible substantial savings in handling a broad range of low production work. They are designed with standard indexing tables mounting multiple-spindle heads, and are equipped with quick locating fixtures and shuttle-type feed units that move the work to the tools. Electrical contact devices for each station are mounted overhead, and are the self-cleaning type. Contacts are fully interlocked and enclosed when in operation, with remaining contacts de-energized when out of operation. The versatility of these new machines with capacity for handling more than one workpiece, offer three-way savings. For example, for a road equipment manufacturer, machines illustrated provided up to 80% savings in floor space over any other processing method, and reduced equipment cost up to 50%. Handling many operations simultaneously, achieved high efficiency with less work handling. Now, for larger and smaller work, the new Barnes "Versa-Matics" are available in a range of standard sizes to serve your specific production requirement.



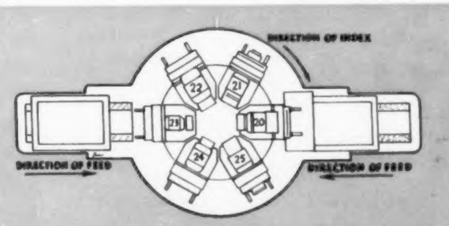
MACHINE No. 3

Standard Barnes "Versa-Matic" with Center 6-Station Rotary Table and Two Shuttle-Type Work Holding Fixtures. Drills, bores, chamfers, and taps same workpieces A, D, and E processed in Machine No. 1 and 2, and also workpieces F and G.

	Case Parts	Gear Covers
Approx. Loading Time per piece	3.00 min.	2.00 min.
Approx. Unloading Time.....	2.00 min.	1.00 min.
Gross Production (100% E.) . .	4.73 per hr.	5.00 per hr.

HEAD OPERATIONS

Unit 20: 4-spindle semi-finish boring head
Unit 21: 4-spindle semi-finish boring head
Unit 22: 21-spindle drilling head
Unit 23: 21-spindle chamfering head
Unit 24: 13-spindle tapping head
Unit 25: 4-spindle finish-boring head



WRITE FOR MORE DATA

If you have similar small lot work requiring multiple machining operations where competitive costs must be maintained, it will pay you to get full facts today on the new Barnes standard "Versa-Matics." Cost analysis will be gladly rendered without obligation.

W. F. & JOHN BARNES

Builders of Better Machines Since 1872

W. F. & JOHN BARNES COMPANY

402 SOUTH WATER STREET • ROCKFORD, ILLINOIS

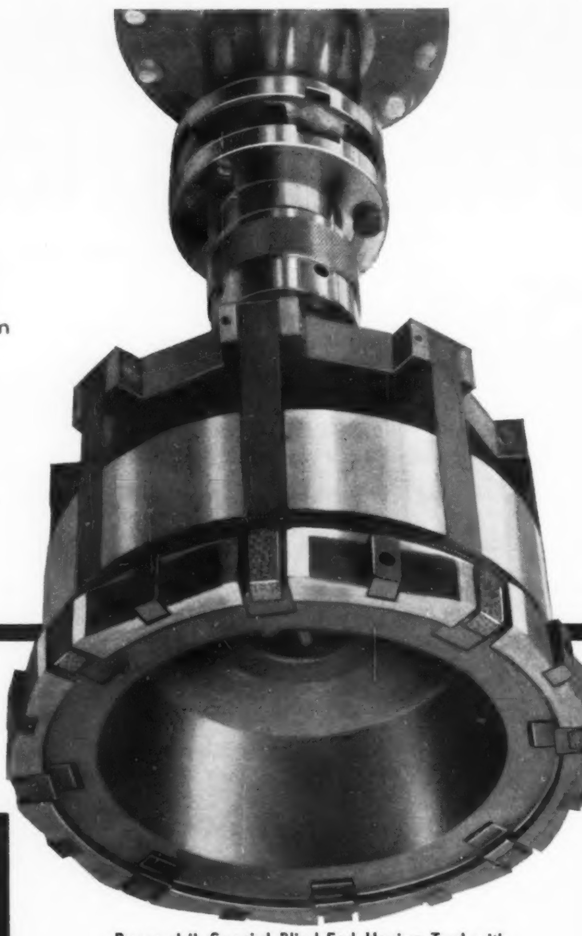
Multiple Spindle Drilling • Boring • Tapping Machines • Automatic Progress-Thru Transfer-Type Machines

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

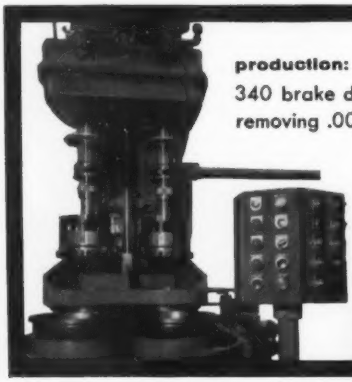
BARNESDRIL

special honing tool

answers unique finishing problem



- **removes taper**
- **corrects out-of-roundness**
- **applies selected finish**



production:
340 brake drums per hour, removing .003" to .005" stock.

BarnesdriL Special Blind-End Honing Tool with Adjusting Head utilizing Plas-T-Clad stones.

The honing tool that does all these things has been developed by BarnesdriL engineers, specifically for a brake drum manufacturer.

The drums represent a blind end bore of 11" in diameter and 2¼" deep. In order to reproduce the specified requirements, BarnesdriL engineers designed a special honing tool, Model HFB-8. This tool is a Special Blind End Lever type honing tool, utilizing eight clamp-type stones. The tool removes .003" to .005" stock from the sides of the brake drum. The finish is held between 80 and 100 RMS and the bore is honed diametrically straight.

Two of these tools are mounted on a 2-Spindle Ram Type Machine that provides a positive stop and dwell for blind end honing. Final production is 340 drums per hour.

custom-honing service for special short-run applications.

Send us your short-run pieces, with specs and finish requirements for prompt honing by expert technicians.

50th year

BARNES DRILL CO.

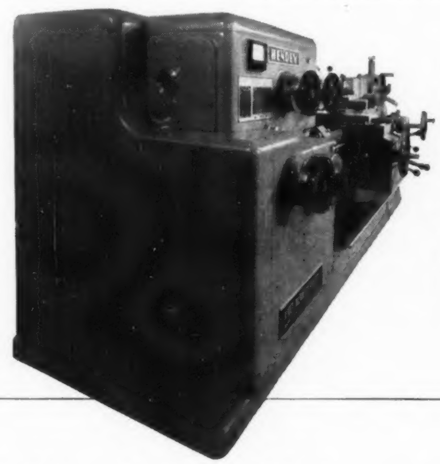
820 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

Barber-Colman's new 36-speed lathe

gives you the three things you need to profit from throwaway tooling!

PROFIT POINT TURNING



Throwaway tooling suddenly makes modern lathes a financially attractive investment. High spindle speeds are important, but so are rigidity, ease of operation, and precision. With expendable cutting tools and the right machine, higher speeds can add new dollars to today's low profits.

The biggest victory for carbides in 20 years is throwaway insert tooling!

And now is the time to invest in a new Barber-Colman 36-speed lathe . . . which combines precision, high speed, and ease of operation . . . to take advantage of the new savings made possible by these *expendable* cutting tools.

Speeds up to 2000 rpm are available for faster cutting — not at yesterday's rates calculated to prolong tool life — but at today's and tomorrow's rates designed to give economical tool life. You might spend more for carbide, but other savings make a big difference in the value added to the piecepart.

Rigidity where you need it

Negative-rake throwaways require power and rigidity. And here's where many old machines fail. Barber-Colman's carriage, cross slide, tailstock, and spindle are designed for heavy-duty, accurate work. Look at the depth of the apron which takes the thrust load from the tool. The carriage has a wide 30" span over the ways and guides on the front V-way right under the compound. The tailstock weighs over 400 lb, and two heavy clamps hold it rigidly even when cutting workpieces of maximum size.

Controls for busy operators

But, why use indexable, quick-change tools on lathes which waste hours per day because they're difficult to set up and operate? All controls on the "Barber-Colman" are human engineered to save time on high-production or short-run jobs. Only two dial-type, quick-reset handwheels mechanically actuate all 36 speed changes. The drive clutch can be operated from the apron *or* headstock. Engagement and direction of longitudinal-feed and cross-feed actuation are controlled from the apron, which also provides a thread-chasing dial and handle for engaging the half nuts.

No vibration from spindle

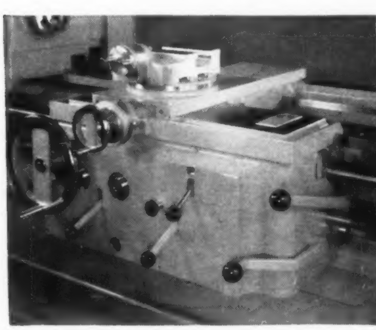
Speed, rigidity, and ease of operation are only part of what's needed for tomorrow's faster machining. Precision is a "must"— that's why Barber-Colman provides a *balanced*, accurately ground spindle supported at both ends and in the middle by *three sets* of precision tapered roller bearings. An automatic spindle bearing adapter gives a constant preload at all spindle speeds. You can do better work with precision inserts because there is no spindle vibration — use your lathe for both toolroom and production turning.

See a demonstration

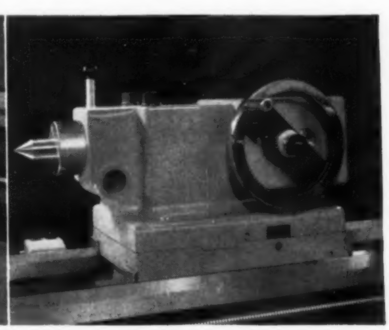
Before you buy a new lathe, see this one operate! Your Barber-Colman representative or dealer can arrange a demonstration either in his showroom or in Rockford.

Write for more information

New 16-page catalog will show you how the new Barber-Colman 36-speed lathe can pay for itself quickly as a replacement for an old lathe. It describes and illustrates the full line of threading features you want for toolroom and shop work. Write for a copy today.



Heavy-duty apron provides maximum rigidity and ease of operation. Carriage rides on front V-way, front flat-way and rear flat-way.



Heavy-duty tailstock weighs over 400 lb, yet can be positioned quickly and easily with one hand due to special antifriction mounting.

Barber-Colman Company
112 Loomis Street, Rockford, Illinois

Don't expect a day's work for a day's pay on yesterday's machine tools

BARBER COLMAN ®

PRECISION LATHES

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

Greenlee Transfer Machines can be Reworked to meet Product Changes

The Greenlee "Rearrangeable Unit" concept of transfer machine design is becoming increasingly popular in mass production manufacturing. These machines accommodate recurring changes in product design. Year after year they guard against costly obsolescence . . . they are changed to meet your changing requirements. Get the complete story from Greenlee.

PRODUCTION MACHINERY
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- Core Box Rollover and Draw Machines
- Specialized Woodworking Machines
- Hand Tools for Woodworking
- Tools for Woodworking Machines
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GREENLEE GUARDS AGAINST COSTLY OBSOLESCENCE

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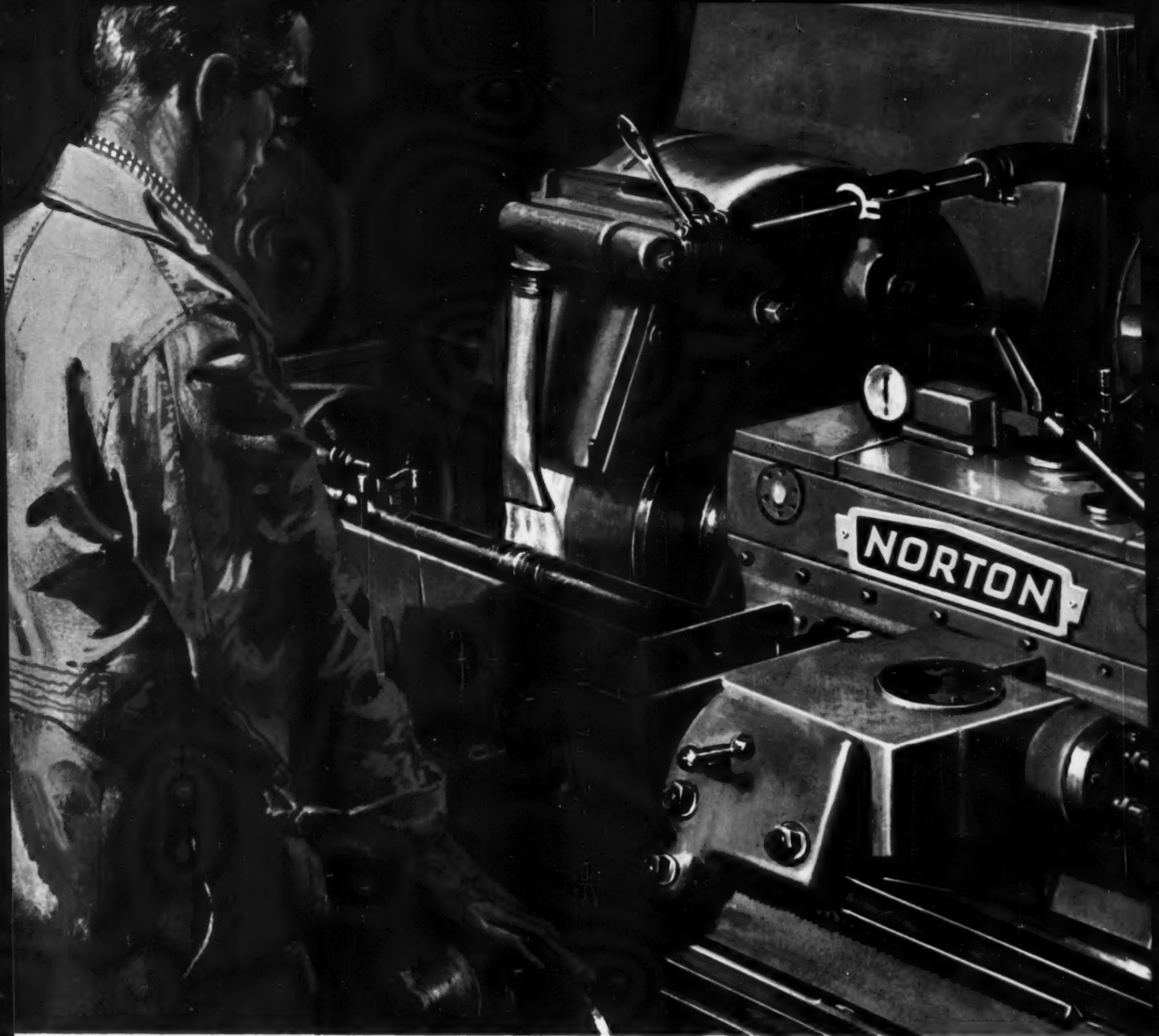
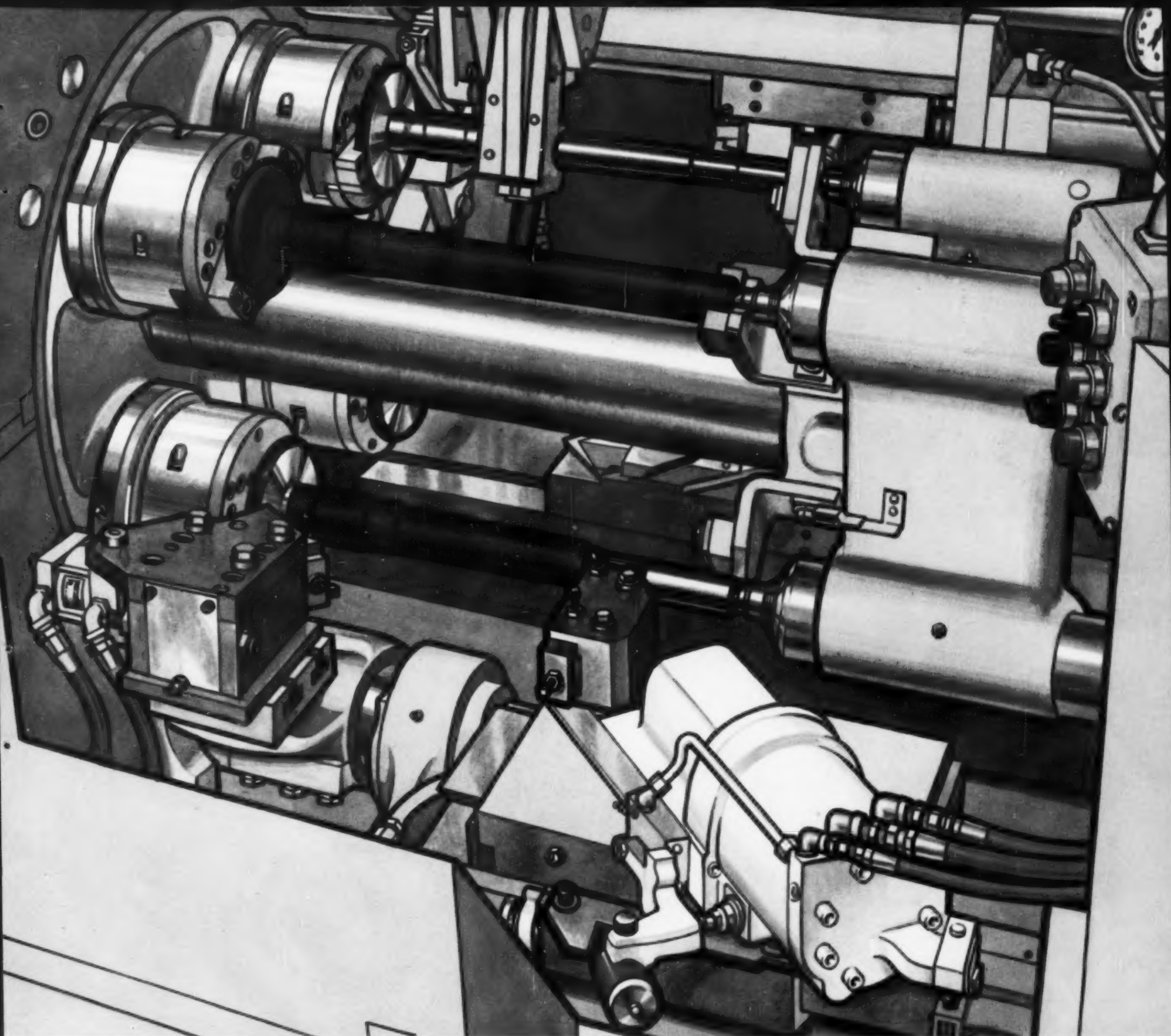
MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



Continuous high production plus precision are built into this CTU cylindrical grinder.



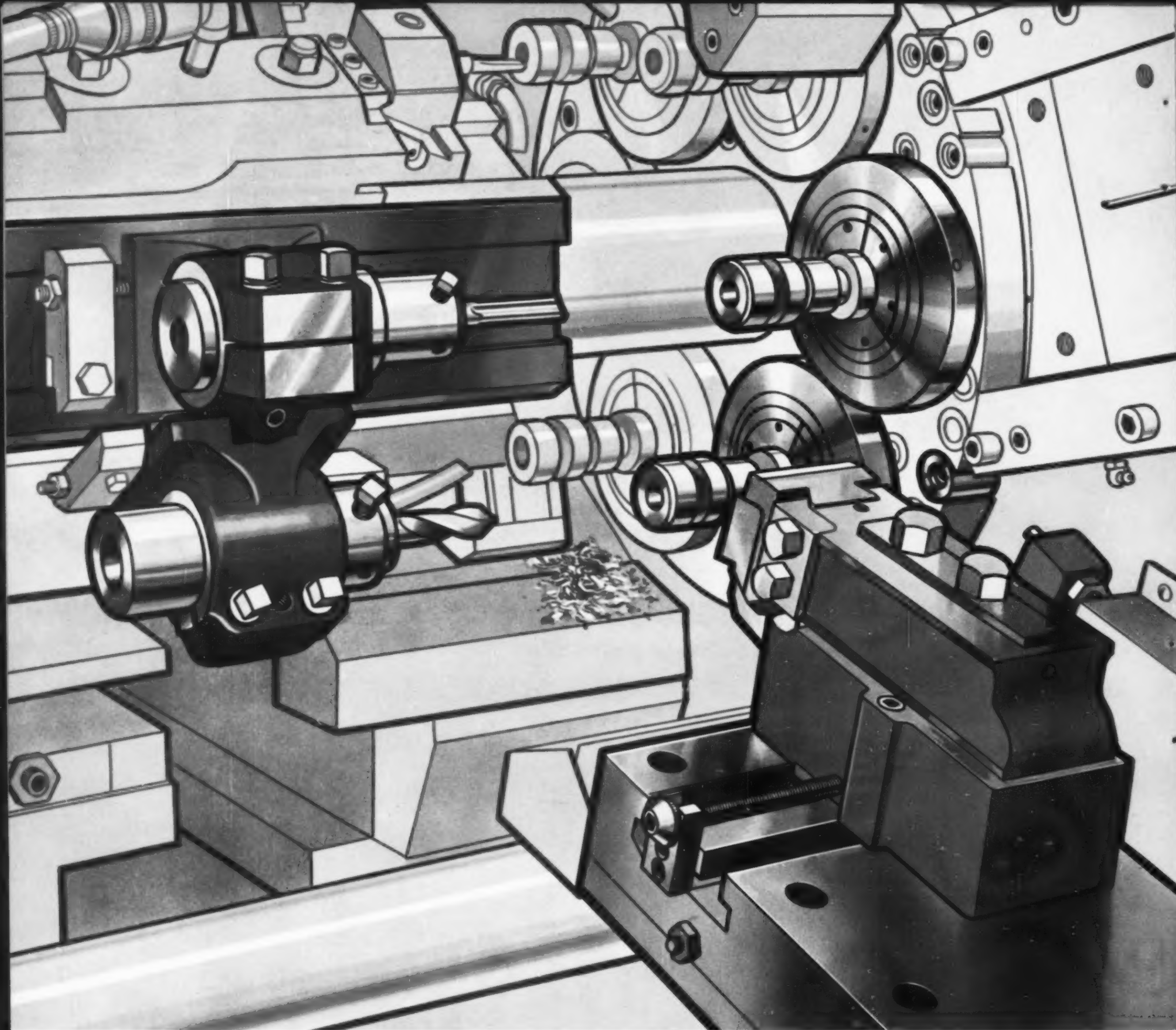
copy more than three times faster on

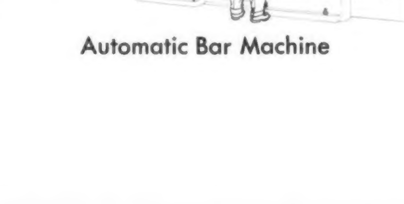
New Britain 4-spindle copying lathe

THE NEW BRITAIN MACHINE CO.
NB

For the first time . . . multiple spindle copy turning. Loading station and three work stations. Work chucked between centers which index together. Template-controlled hydraulic slides perform copy turning; cross slides and/or forming arms perform a wide variety of additional operations. Two-speed spindles, automatic loading and unloading, and automatic chip conveyor optional. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.

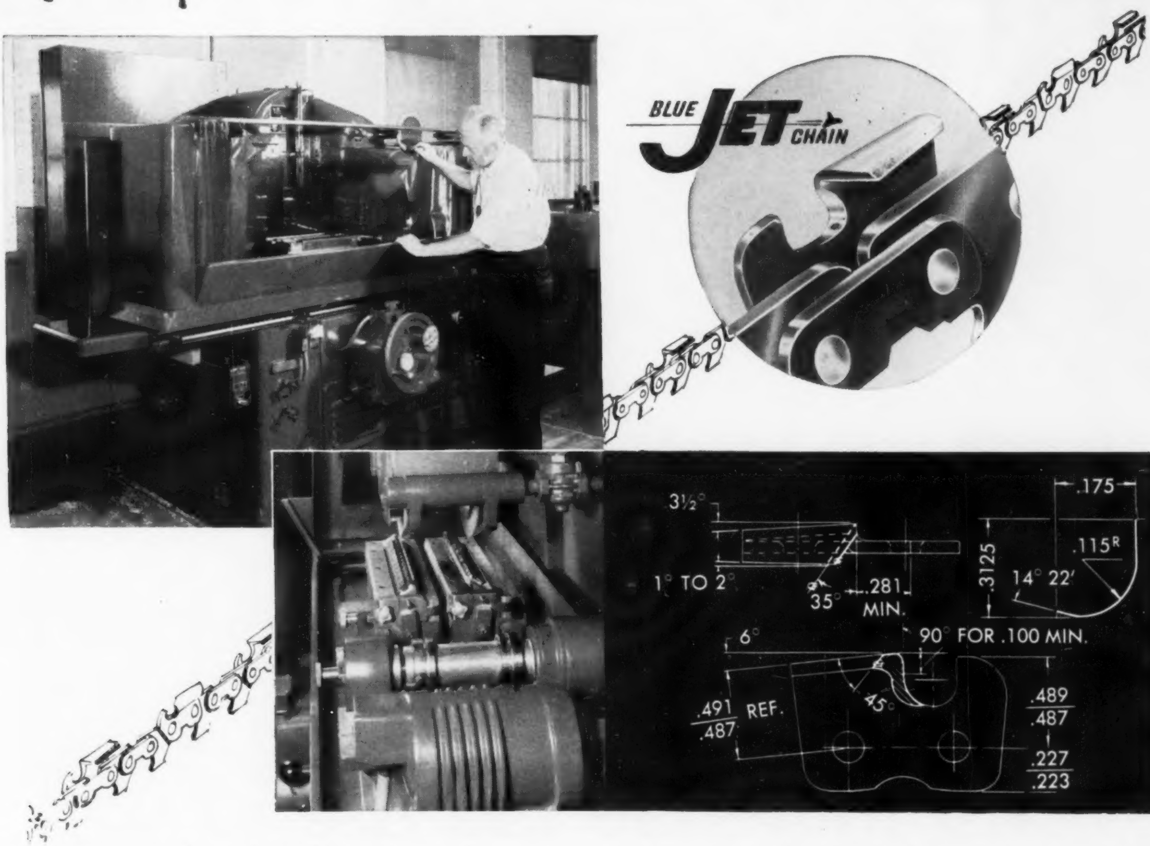
Model 412/25 Copying Lathe





Automatic Bar Machine

Thompson TRUFORMING CUTS COSTS 60%



For 140 years, the policy of The Draper Corporation of Hopedale, Mass., has been to offer the highest quality product at the least possible cost.

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For 25 years, Thompson has pioneered and developed the modern advances in crush form grinding. If you have a time-saving, product-improving or cost-cutting problem in your operations, it will pay you to investigate the work Thompson Truforming grinders are now doing in plants all over the country. Our engineering experience is available to you without obligation. Write for Catalog T558.

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Operating costs can be greatly reduced because of Elcide 75. This saving is an accumulation of several important benefits.

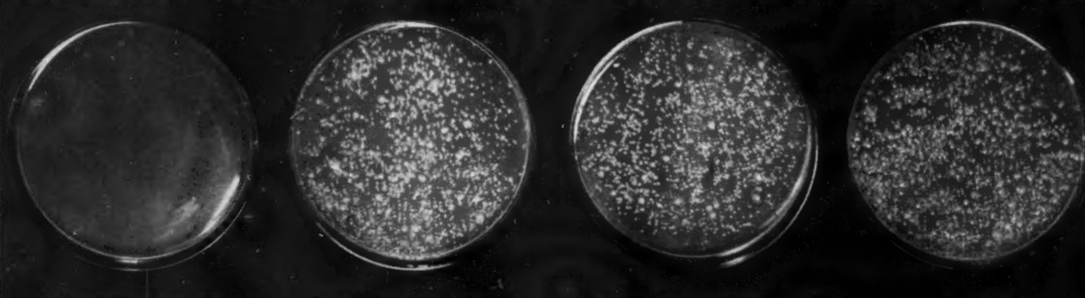
Actual shop tests have shown that one ounce of Elcide 75 added to each four gallons of emulsion can keep the oil-water emulsion fresh as much as 5½ times longer. In one test, emulsions that normally had to be dumped at the end of four weeks ran for 22 weeks when treated with Elcide 75!

You can benefit by three direct savings—costly labor and down time for recharging will be reduced, your soluble oil requirements will drop, and the disposal cost of spoiled emulsions will diminish.

Elcide 75 also contributes to better products and longer machine tool life because it controls the bacteria which often cause acidic corrosion.

You can have a cleaner plant by using Elcide 75. It eliminates objectionable odors as well as bacteria that may cause skin infection. Elcide 75 is nontoxic and safe to use, as proved by tests conducted under normal shop conditions.

BACTERIAL PLATE COUNTS PROVE KILLING POWER OF ELCIDE 75



Emulsion treated with Elcide 75	Emulsion treated with commonly used germicide at recommended level	Emulsion treated with commonly used germicide at double the recommended level	Untreated emulsion

The photographs shown above illustrate the broad, powerful anti-bacterial action of Elcide 75. The light areas are bacterial colonies that have grown in three of the emulsion samples during 8 weeks' use. Note that none of these harmful bacteria appear in the emulsion treated with Elcide 75 during the same 8-week period. The emulsion stayed fresh.

PUT ELCIDE 75 TO WORK FOR YOU

The best way to determine the value of Elcide 75 to your own operation is to try it under normal plant conditions, using your regular oil-water emulsion. After you compare the costs of operation, you will agree that Elcide 75 is a valuable discovery that deserves a permanent place in your plant. Why not try Elcide 75 soon?

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ELCIDE 75

(Lilly's brand of bacterial inhibitor for cutting fluids)

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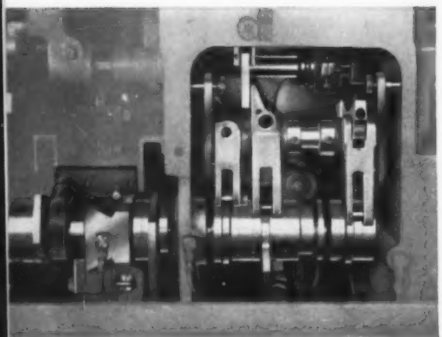
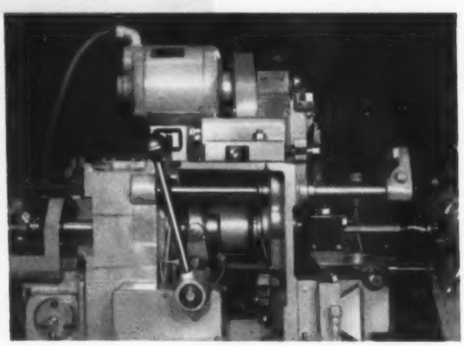


DESIGNED FOR FAST SET-UP AND MAXIMUM CONTINUOUS PRODUCTION—Slide and attachment cams (above) are quickly mounted on sliding shaft, lock securely in position. Below: Slides have micrometer adjustment, are readily accessible to simplify machine operation.



A NEW ADDITION TO THE BAKER LINE

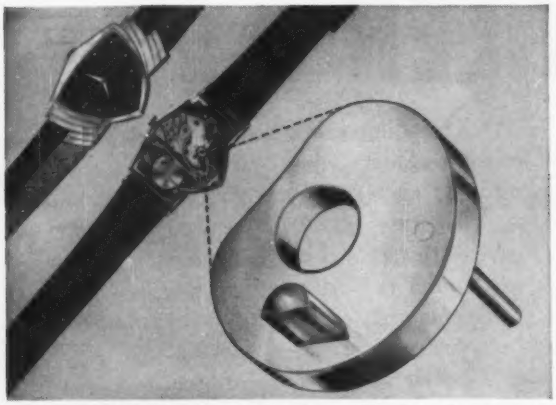
The Baker Automatic Bar Machine overcomes traditional limitations in spindle speed and parts length. This standard ¾"-capacity machine permits high-speed machining of parts up to 18½" long without "trick" tooling. A dependable, instant-reversing transmission allows different spindle speeds for six different cutting operations, with speeds in any cycle infinitely selectable up to 7200 RPM. Revolutionary unit construction ends obsolescence, slashes maintenance cost and downtime. The Baker Automatic Bar Machine is available *now* to expand your production.

BAKER BROTHERS, INC.

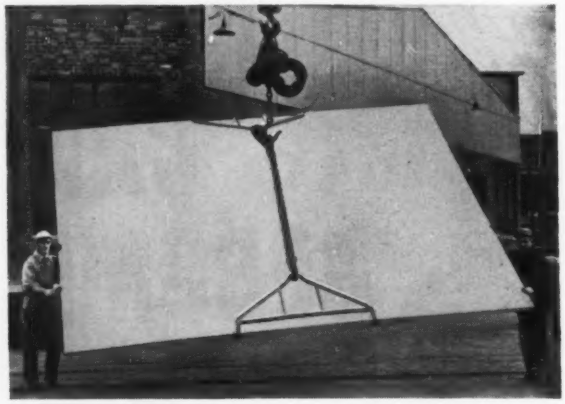
TOLEDO 10, OHIO

1/7000 OF AN OUNCE or

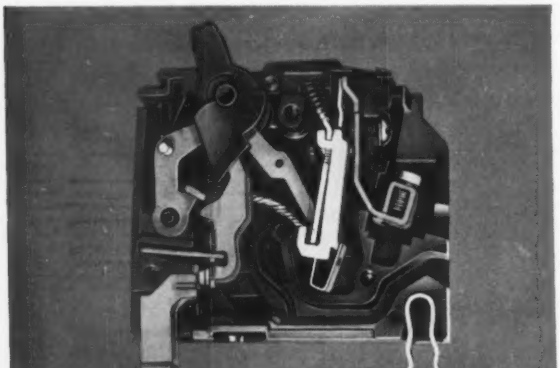
7 tons. In metals, it's the right combination of properties that counts. So just specify the properties you need. You may find the answers from Anaconda very interesting.



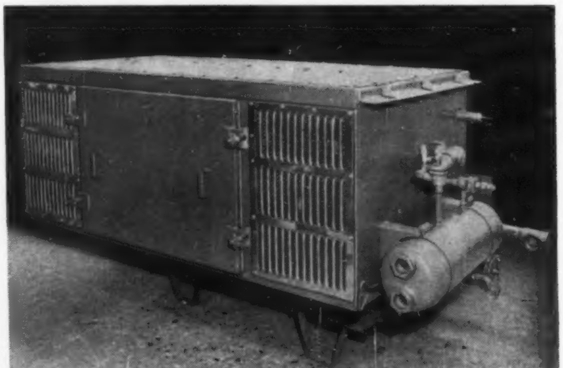
HAMILTON WATCH CO., for the world's first electric wristwatch, demanded these qualities in metal for a vital 1/7000-ounce indexing roller – high hardness and tensile strength; ease of blanking, machining; nonmagnetic properties. Anaconda Ambraloy-901 met the need perfectly. The magnified pinhead-size assembly shown above has a half-round sapphire jewel. The pin limits balance motion.



ALLIS-CHALMERS – building what may be the world's largest surface condenser for Commonwealth Edison Co. – needed tube sheets which combined strength and corrosion resistance with machinability. The answer was Anaconda leaded Muntz metal – 4 plates, each 13' x 17', 1½" thick, weighing over 7 tons. When drilled, plates support 21,960 tubes, for 200,000 square feet of condensing area.



SQUARE D COMPANY needed low electrical resistance, high spring properties, fatigue resistance in critical parts (in color above) of their QO circuit breaker. Electrical resistance of ordinary phosphor bronzes was too high. So was the cost. Engineers of The American Brass Company suggested Anaconda Ambronze-474 and Square D found it had the right combination of properties for the need. And this metal provided superior forming and lower material costs.



THE TRANE COMPANY'S railroad air-conditioning "dry-wet" combination condensers are mounted under cars – facing severe corrosive conditions and a beating from roadbed gravel and stone. Exposed metal, including casing, liquid receiver, 170-gal. water tank, must have superior corrosion resistance, high strength and toughness. Trane has found Everdur®, Anaconda's group of copper silicon alloys, meets its needs. And Everdur is easy to fabricate.

Starting with 93 standard alloys, The American Brass Company can make minor variations in composition, fabrication, and annealing to provide an almost unlimited number of combinations of useful properties. When new or unusual problems rise, ask for the help of the Technical Dept. in selecting the right metal. For such help or a copy of Publication B-32, "Anaconda Copper & Copper Alloys," write: The American Brass Company, Waterbury 20, Conn. 5854

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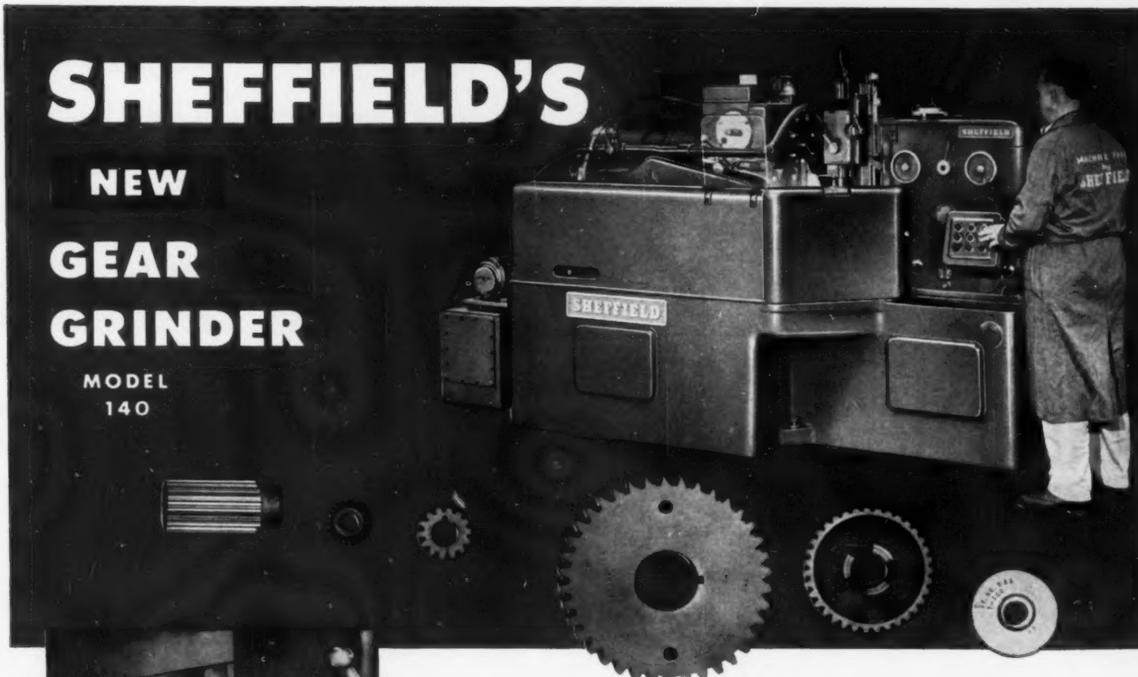

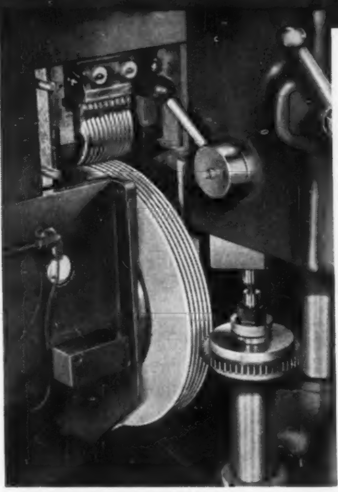

Relationship of crushing roll, grinding wheel and work part.

Precision gears for aircraft, fire control, servo mechanisms, guided missiles, transmissions and machine tools may be ground to a total composite error of less .0005" at production rates three times faster than heretofore possible.

The secret is a fast-cutting grinding wheel accurately crushtrued to the basic rack form, operated like a hob and with the work rotating as the teeth are ground—either from the solid hardened blank or a preformed gear.

FIELD REPORTS—An aircraft engine manufacturer says "Gears ground on the Model 140 Grinder have passed our surface tempering inspection and show no grinding burns".

A large precision instrument manufacturer, in speaking of the Model 140, writes, "We have inspected gears ground on prominent gear grinders of both American and European manufacture. Our findings have revealed that this machine is by far the most accurate to date."

MACHINE CAPACITY (Work Gear)

Outside Diameter	Up to 8"	Pitch	8 to 100
Face Width	Up to 5"	Helix Angle	Up to 45°
Distance between centers	15"		

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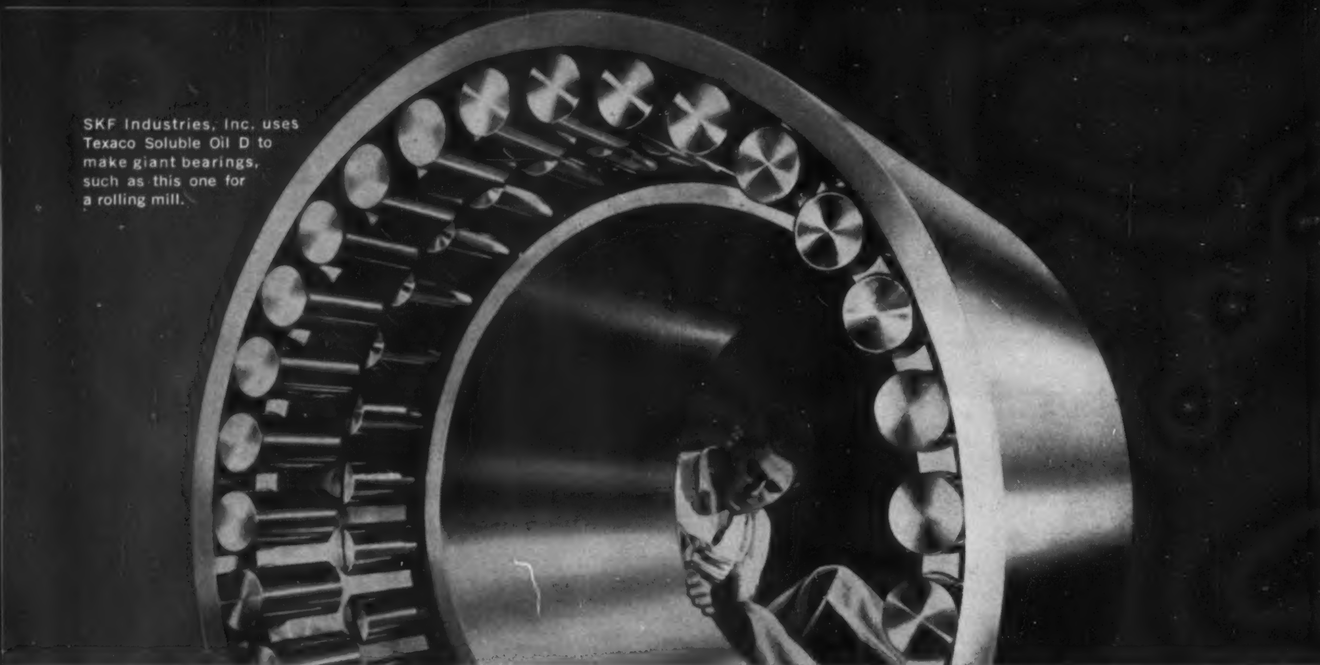
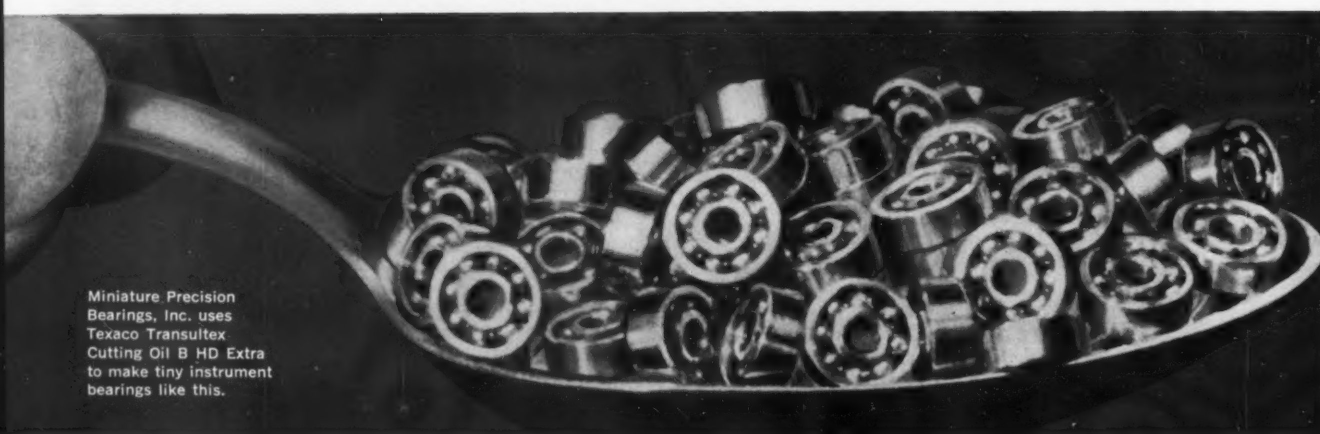


SKF Industries, Inc. uses Texaco Soluble Oil D to make giant bearings, such as this one for a rolling mill.

WHAT SIZE IS YOUR MACHINING PROBLEM?



Miniature Precision Bearings, Inc. uses Texaco Transultex Cutting Oil B HD Extra to make tiny instrument bearings like this.

If you make anti-friction bearings of any size, you need grinding fluids that prevent rust and produce uniformly fine finishes. These fluids must also take into account the bearing material and the operating condition of your machines. They must have specific stability, cooling properties and ability to settle grinding dirt quickly. Otherwise your production drops and the number of rejects rises.

The makers of the small and large bearings shown above get fine bearing finishes and high production by using Texaco. There is a complete line of Texaco Cutting, Grinding and Soluble Oils to help improve machining on every job.

Take this tip. Use Texaco Cutting, Grinding and Soluble Oils—they'll help you produce faster, better and at lower cost, whether your product is the largest or the smallest.

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LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

- **Recession's Demise Official**
- **Machines Pace Upturn**
- **Deficits Tempered, Temperable**
- **Operation Contact**
- **Washington Briefs**

Keeping up with Washington

Loring F. Overman

THE DEPARTMENT OF COMMERCE and the Securities and Exchange Commission are authorities for the forecast that October 1 will mark the end of the 1958 recession.

Investment in new plants and equipment was expected by Commerce Department and SEC surveyors to turn upward during the last quarter of the year, removing one of the few remaining brakes on the economy. The dollar story of peak-valley-upturn starts with the third quarter of 1957, when the annual rate for business investment in new plant and equipment was a record \$37,750,000,000. The slump between the third quarter of 1957 and the first quarter of 1958 dropped the annual rate to \$32,410,000,000. A continued downward trend in the second and third quarters resulted in an annual rate of \$30,320,000,000.

The forecast for the fourth quarter of 1958 is an annual rate of \$31,020,000,000—a figure which, surprisingly enough, is higher than the peak reached in 1953 during the previous business cycle.

Machines Pace Upturn

Washington observers point out that industry is seriously interested in new machinery and equipment that promise savings in labor, material, and capital investment. Industrial investment will be directed more toward modernization than expansion, observers find.

The trend toward automation is extensive in big industries, with both management and labor watching apprehensively. Industry is becoming convinced that batteries of tape-controlled machines do pay off in productivity and reduced labor costs. Labor, in turn, is assembling figures analyzing the problem of displaced workers. Reportedly, labor is concerned not only with new machines but with the tendency of management to transfer an entire operation to a new plant in an area outside present industrial centers.

Such a move, it is pointed out, places the company in a new and modernly equipped plant. In one instance, 25 per cent fewer employes were required. Besides this, the move left several thousand displaced workers in an already surplus labor market. Industry is quick to point out that, as in the past, any displacement caused by use of new machines will undoubtedly be absorbed by the creation of opportunities in other lines. Labor is unconvinced, but Commerce Department-SEC observers seem sure the 1959 outlook for machinery makers is bright.

Deficits Tempered, Temperable

Although intrigued by the money-saving possibilities of labor-saving machinery, the business community is becoming actively concerned with the idea that billions can be trimmed from the Federal budget.

Eyeing the new \$80,000,000,000 budget for fiscal 1959 (actually \$79,200,000,000), business organizations are proposing two approaches to avoid future deficits like the current \$12,200,000,000 figure. Suggested methods are:

1. Revise the present confiscatory tax system, removing the principal roadblock to business expansion. This, in turn, would enable business to produce tax revenues required for essential government.
2. Eliminate all wasteful government expenditures.

The Budget Bureau points out that about 60 per cent of this year's \$12,200,000,000 deficit is due to a reduction in anticipated receipts; the remaining 40 per cent, to increased expenditures.

Operation Contact

Business and industry are conducting a determined drive to convince Congress—newly elected members as well as those held over—that both expenditures and taxes must be cut.

Particular targets of the contact-Congress campaign will be the spending schemes which failed to pass during the recent session, but which will undoubtedly be reintroduced next January. Budget Director Stans indicated that appropriations voted by the recent Congress would have been \$5,500,000,000 higher (spread over several years) if programs approved by one branch of Congress had not been rejected by the other, or vetoed by the President.

Tax-cutting favored by machinery associations and others would require legislation along the lines of proposals by Representatives Sadlak (R-Conn.) and Herlong (D-Fla.). Recommended are five annual reductions in personal and corporation income tax rates, so that each would be lowered to a maximum of 42 per cent—instead of the present 52 per cent rate for corporations and personal income tax rates ranging to 91 per cent.

Washington Briefs

Cutting-Tool Project: A search for methods of reducing cutter breakage when working with high-strength steel alloys—required by the Air Force—is under way. The project is under the direction of Air Materiel Command's manufacturing branch, Wright Patterson Air Force Base, Dayton, Ohio. After a preliminary test, the AMC reached the conclusion that "tools now commercially available are not suitable for machining high-strength alloys, because they lack sufficient transverse rupture strength."

New Extrusion Process: Available to industry is a report of a new method of producing extruded titanium alloys at low cost. According to the AMC, (where the report is available), the sections extruded had close tolerances, high physical properties, and high integrity. The report includes data on press speed limitations, billet temperatures, and heat-treatment.

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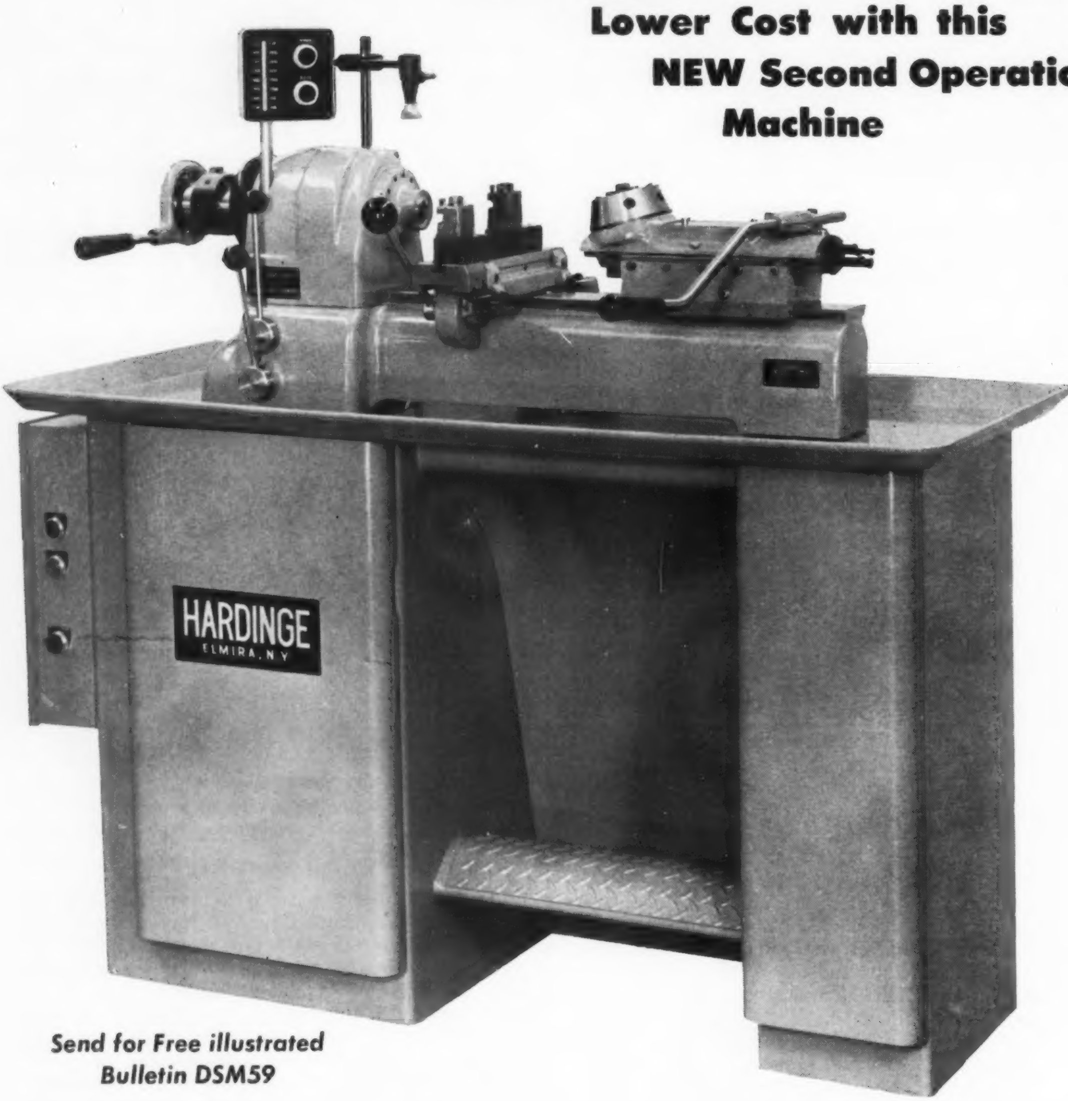

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HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.

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Sound Design Requires Production Knowledge

ECONOMICAL MANUFACTURE necessitates that the designer of a product be familiar with practical production methods. Far too often the designer will concentrate on the appearance and performance of a product and leave the method and cost of manufacture up to the shop because he knows too little about production methods to visualize the processes involved.

A much more satisfactory condition exists when the designer himself is qualified to decide how the part can be most efficiently made. He can then make modifications in a design in favor of minimum manufacturing costs, and usually without detriment to the appearance of the product. Engineering departments have known of extreme instances when a part simply could not be made as designed.

The Chrysler Corporation recently undertook the most extensive and expensive tooling program in its history. Approximately $300,000,000 were spent in carrying out this program. Thousands of tools—3400 dies alone—had to be made for turning out newly designed parts.

In any program of such magnitude, production difficulties are certain to occur at the outset because designers cannot be expected to anticipate all contingencies. However, in this case, Chrysler executives felt that the cost involved in changing tools to overcome defects in design was excessive. They decided to do something about it.

A training course, devised as part of the evening school program of the Chrysler Institute of Engineering, is offered to engineers having a Bachelor of Science degree in engineering or product-design experience. All major production processes used in the automotive industry are covered in this course. The instructor for each process is a manufacturing specialist in his particular field. As each process is discussed, specific examples are presented to show "before" and "after" designs and their effects on tooling and production. It is constantly emphasized, however, that the manufacturing aspects should not be stressed to the point where styling and design are adversely affected. The aim is to help the designer choose the design best suited for production when several choices are available.

MACHINERY has been most fortunate in obtaining authority to publish selected units of this course. They will appear as Reference Sections. The first article in September MACHINERY dealt with plastic materials and processes. The October issue carried an article that discussed the specifying of tolerances and surface finishes on components. In this issue casting design and foundry methods are considered.

Some of the information in this series of articles will seem elementary to experienced process engineers. However, the material should be of special value to younger production men, tool engineers, and students, and constitute a worthwhile refresher course for experienced designers.

Charles O. Herb
Editor

Spark testing by skilled Ryerson inspectors protects against possibility of mixed steels.

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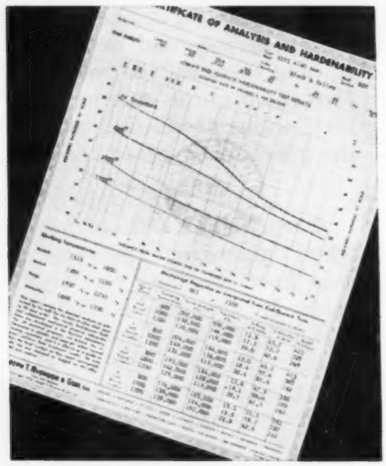

With every shipment you receive a Certificate of Analysis and Hardenability—your complete record of the steel's characteristics, and your guide to dependable heat treatment.

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LONG-RANGE PLANNING FOR SHORT-RUN PRODUCTION

Here's how one company is employing versatile, modern machine tools and production methods to help eliminate many of the difficulties normally encountered in repetitive, but short-run operations.

HAROLD W. BREDIN, Associate Editor

ECONOMICAL MACHINING of parts in limited numbers is essential to many manufacturers. But the problem is more often an extensive one to specialized equipment makers such as the Farris Engineering Co., Palisades Park, N. J. Cognizant of increasing competition for available markets, this company has adopted an aggressive program for modernizing its machining methods and facilities. Emphasis is being placed on greater versatility of tooling as well as improved production methods. Wherever it can be used to advantage, automatic equipment has been acquired.

Safety and relief valves, which constitute a major portion of the company's production, are made in numerous types and sizes. Many of their parts are seldom machined in lots greater than a hundred pieces. Often, much smaller quantities are processed.

Typical of the approach to the short-run problem at Farris is the fact that, for some time,

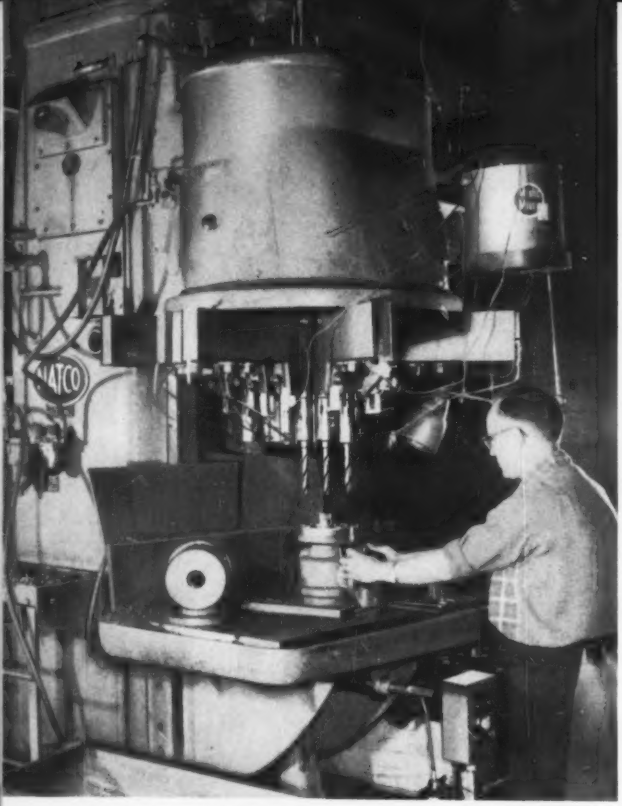

Fig. 1. This multiple-spindle drilling machine is used extensively for short-run operations. Here, four holes at a time are being produced in the outlet flange of a safety-valve body.

multiple-spindle drilling has been used for numerous applications. Success with this equipment has led to the recent installation of the Natco Holesteel, multiple-spindle drilling machine seen in Fig. 1. This vertical, general-purpose unit is equipped with twelve, adjustable type spindles and has a hydraulic feed system capable of exerting a total pressure of 16,000 pounds on the drills.

The illustration shows the operator aligning a jig prior to drilling four 3/4-inch bolt holes in the outlet flange of a cast-iron valve body. High-speed drills are being used at a rotational speed of 320 rpm and a feed of 0.007 inch per revolution. In a similar setup, eight 3/4-inch holes are produced in the inlet flange of a cast-steel valve body with drills rotating at 320 rpm and feeding at 0.0066 inch per revolution. Setup of this machine is accomplished in about ten minutes and is facilitated by using the jig plates to help align the drill spindles. An oil-mist coolant is supplied to the drills by the Mistic Mist generator seen attached to the head of the machine at the upper right in Fig. 1.

Since excessive corrosion could be detrimental to the operation of safety valves, many parts are made of stainless steel. In Fig. 2, blanks for a valve disc made of Armco 17-4 PH stainless steel are being cut from a 2 3/4-inch diameter bar on a DoALL power cut-off machine equipped with automatic stock feed. The blade is a Demon high-speed steel saw band having six teeth per inch. It is operating at 185 feet per minute. The feeding pressure is 2 pounds.

Self-alignment of the disc is an important functional feature of Farris safety valves. This is made possible by a smooth and accurately machined, spherical surface located on the top of the disc which is generally made of stainless steel. Until recently, the spherical surfaces were produced in a turret lathe using special form tools. But constant regrinding and resetting of the tool to maintain the required 32-micro-inch finish and

Fig. 2. Blanks for safety-valve discs being cut from stainless-steel bar stock by an automatic power cut-off machine. Saw band, made of high-speed steel, is operated at a speed of 185 feet per minute.

a tolerance on the radius of plus 0.000 inch, minus 0.002 inch made this method slow and costly.

To improve the machining of these discs, the company installed a Warner & Swasey ram type turret lathe (Fig. 3) equipped with a cross-slide contour attachment. This machine has a hydraulically operated turret mounted on the cross-slide that can be used for both turning and facing. On this equipment, the required spherical surfaces are now being produced with a single-point tool guided by the tracer which follows a flat template having the same contour as the work-piece. Production of the discs has been greatly accelerated and tolerances are easily maintained.

When the tracer attachment is not required, the machine can be operated in the same manner as any other turret lathe. The availability of the tracer equipment, however, has led to its successful adoption for other applications. One example is a nozzle for a safety valve made of AISI 304 stainless steel which was previously machined on a conventional turret lathe. A tool in the tracer-controlled turret is now used to face one end, turn three surfaces, and cut a chamfer, all in a single pass. Additional operations required to complete the nozzle are performed on the same machine in the usual manner. The setup for machining this work-piece, including the flat type template, is seen in Fig. 3. These templates are economical to produce and, on the average, can be made in about three hours. In addition, they are easily stored for future production of the part. Average setup time for the machine when tracer-controlled operations are used is about three hours.

Many parts made by the company are produced from castings that are chucked for machining. Spring chambers, typical of cast parts requiring many operations, are produced on a Warner & Swasey chucking machine having automatic cycling. In Fig. 4, the operator is seen clamping a partially finished, cast-steel spring chamber in a centering fixture attached to the faceplate. The machine has a five-position overhead turret that automatically indexes and can be set to advance tools parallel to the axis of the spindle at various feeds and lengths of stroke. In addition, two cross-sides are provided, one at each side of the faceplate.

The tool sequence for the setup shown is as follows: tools at the first station of the overhead turret chamfer a bore to be threaded and rough-turn one surface, while a tool on the front cross-slide faces the part to its over-all length. The turret then indexes to the second station and feeds a 27/32-inch drill through the work-piece as tools on the rear cross-slide form-turn one surface and finish-face a second. At the third station a 3/4-inch boring-bar is used to bore the drilled hole to 7/8 inch in size. For the first three turret stations the spindle is operated at 385 rpm. The feed for both the cross-slides and turret is 0.008 inch per revolution.

On indexing to the fourth station the rotational speed automatically reduces to 116 rpm and the feed changes to 0.124 inch per revolution to permit the tapping of a 1-8 thread. When the operation is completed, the spindle rotation and feed automatically reverse and the tap is withdrawn before the turret indexes to the fifth station. In this final station, 1 3/4-12 threads are chased using a Landmatic die-head at a spindle speed of 83 rpm and a feed of 0.084 inch per revolution. Upon completion of this operation, the turret indexes back to the first station and the machine stops. A typical production run is about eighty spring chambers. The operations de-

Fig. 3. Tool in tracer-controlled, rear cross-slide turret is used to finish-turn the outer surface of a safety-valve nozzle. The flat template can be seen clamped to holder located directly above work-piece.

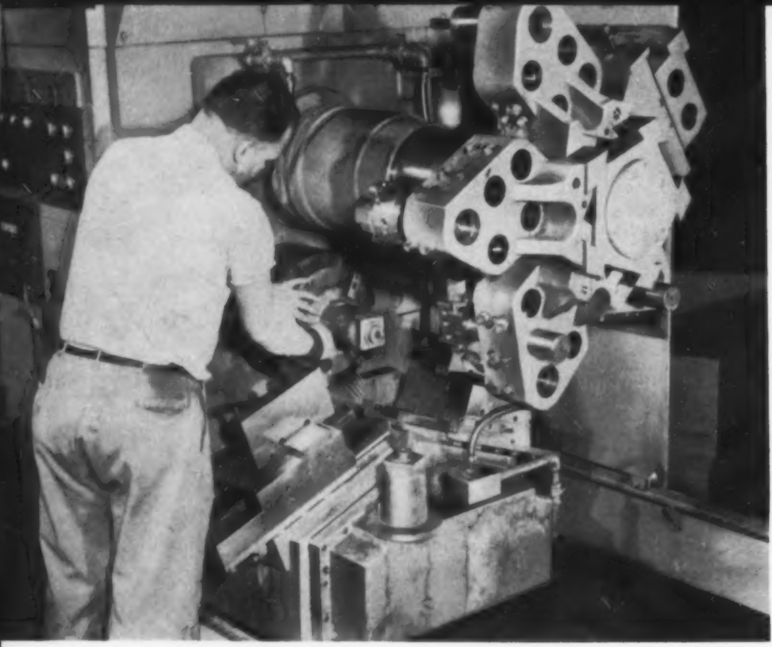

Fig. 4. Cast part for a safety valve is being clamped in position for machining in an automatic-cycling chucking machine. Tools held in a five-position overhead turret and in two cross-slides operate on the work-piece.

scribed are completed at a rate of approximately eleven pieces per hour. This machine can be set up relatively fast, since speeds, feeds, and length of stroke are controlled by adjustable trips on a control drum.

Mechanical and hydraulic governors for controlling the speed of steam, diesel, or gasoline engines are another Farris product. Certain parts for this equipment require a number of accurately machined holes and surfaces having size and positional tolerances in the ten-thousandths-inch range. Close-tolerance boring and milling on these work-pieces are accomplished on a DeVlieg Jigmil (Fig. 5). In the illustration, the operator is seen preparing to bore the main casing of a new model, hydraulic governor. This particular part, which is made of Meehanite, requires two counterbored holes having a tolerance of plus 0.0002 minus 0.0001 inch on the diameter of the holes and on both the depth and diameter of the counterbores. In addition, the tolerance on the distance between the centers of these holes is plus 0.0005 minus 0.0000 inch. The casing is held in a box type fixture which can be used to facilitate operations on two sides of the part.

Lathe operations on castings for safety-valve bodies are economically performed when the work-piece is held in some type of indexing or flip-over fixture. This elminates duplicate setup operations and helps to insure proper orientation of the flanges. Three box fixtures of the type seen in the heading illustration and Fig. 6 are employed for the machining of about thirty different, large-size valve bodies.

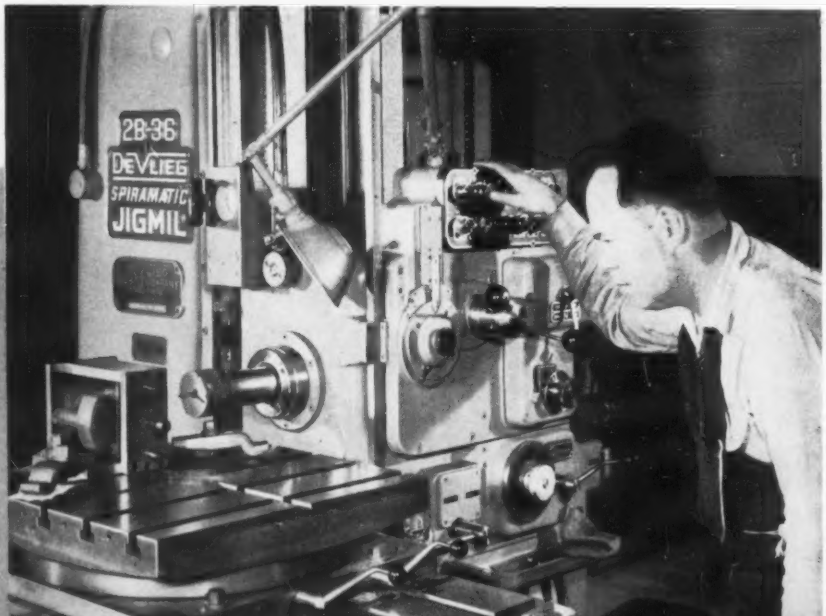

Fig. 5. Operator is about to bore a precise hole in the main casing of a hydraulic type governor. This work-piece requires holes that have close tolerances on diameter, depth, and location.

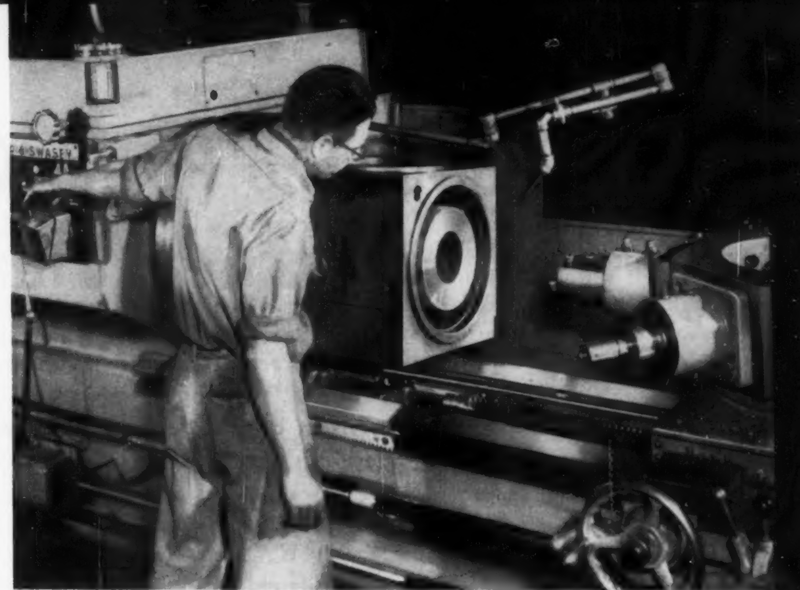

Fig. 6. Versatile box type fixture being used to facilitate machining of a large valve body. Box is chucked in three different positions to complete work-piece. Air-operated clamps secure part in specially designed chuck.

Each box is made in two essentially identical parts for convenience in loading and unloading the work-pieces. An eyebolt located on top of the fixture is used for removing and replacing the upper half during loading, and for transporting the entire box to the lathe after loading. The separation is along the horizontal center line of the four vertical faces when the fixture is held as shown in the heading illustration. Two dowels and four cap-screws position and secure the two box sections together, whereas set-screws align and hold the valve body in place. The box fixtures are nested in a special chuck equipped with air-operated finger clamps and a driving pin. For handling the fixture, a 1-ton traveling hoist on a pivoting beam is used.

In the heading illustration, a loaded box fixture is about to be clamped in the special chuck. A handy control attached to the headstock of the turret lathe opens and closes the two air-operated finger clamps. As a safety feature, the lathe is specially designed to stop automatically if the air pressure to the clamps, normally 90 psi, drops below 60 psi. After each face is machined, the box is supported by the hoist, unclamped, and, if not completed, chucked on another face for the next operation. The cast-steel valve body seen in Fig. 6 has been faced using a rotational speed of 111 rpm and a feed of 0.012 inch per revolution. The tool has a brazed tip of cemented carbide.

Smaller-size valve bodies are machined in a four-position indexing chuck such as the one seen in Fig. 7. The left-hand, box-shaped portion of the holding fixture is cast of Kirksite. These fixtures are economical to produce and have a useful life sufficient for short-run operations. The Kirksite is reclaimable for remolding. However, where production is large enough to warrant it, steel fixtures are employed.

Fig. 7. Indexing chuck and economical fixture molded of Kirksite are employed to hold smaller-size, safety-valve bodies for short-run machining in a turret lathe.

Power and Power Circulation in Gear Trains

Beginning with a clarifying discussion as to the meaning of the term "power," Dr. Tuplin shows why large power losses are inherent in certain gear trains; how these losses are determined; and what steps can be taken to reduce them.

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THE POWER TRANSMITTED by a rotating shaft is equal to the product of its torque and rotational speed. The torque could be ascertained from the size and material of the shaft and its angle of twist in any convenient length. It might not be easy to carry out the necessary measurements, but there is no doubt about the principles of procedure.

But the term "rotational speed" has really no meaning unless it is defined as speed in relation to something specific. The vertical output shaft of a gear-box might have a speed of 20 rpm relative to the box, but in relation to an observer who chooses to stand on the end of the shaft, the rotational speed is zero and the power transmitted, whatever the torque, would to him appear to be zero. Thus, since observers with different angular velocities would deduce different figures for the power transmitted by a shaft at any particular instant, there can be no single figure to represent the power transmitted unless a common basis for reference is defined.

If a single shaft protrudes from a structure *A* and has a speed of, say, 20 rpm relative to that structure, it may be stated that the power transmitted by the shaft from (or to) that structure treated as a whole is equal to the product of the torque in the shaft and the speed of 20 rpm.

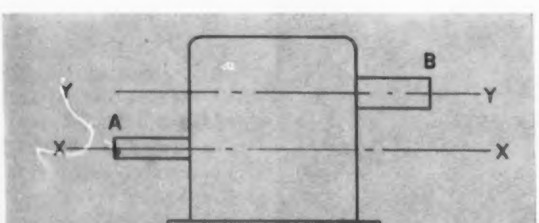

Fig. 1. Schematic representation of power-transmitting mechanism.

To transmit a torque at all, the shaft must be connected, not only to something in *A*, but also to something else (that is, in another structure *B*), that exerts on it a torque equal and opposite to that exerted on it by something inside *A*. The torque-reactions in *A* and *B* are equal and opposite and must cancel each other through some connection (additional to the shaft) between *A* and *B*. This connection may be, for example, a bedplate rigidly supporting *A* and *B*. If it is stated that an observer who wishes to estimate the power transmitted between *A* and *B* must first fix himself in relation to either the bedplate or the shaft and must consider both of them, this eliminates any uncertainty about the value that is to be given to the angular velocity (it is that of either connection relative to the other) and therefore to the transmitted power.

Power Flow

In Fig. 1, the rectangle represents a box from which protrude two parallel shafts *A* and *B* connecting a mechanism inside the box to adjacent machines. The sign of the torque in each shaft is such as to strain it so that a line on its surface parallel to the axis in the unstressed condition becomes part of a left-hand helix. The lines *XX* and *YY* represent the axes of parallel shafts *A* and *B*, respectively.

If shaft *A* rotates relative to the plane defined by *XX* and *YY*, the direction of power flow is that of motion of the intersection of the strain helix with the plane (*XX*) (*YY*). By this means it is easy to see whether in any particular running

condition power is transmitted into (or out of) the box by means of shaft A. The same remarks apply to shaft *B* and to any other shafts that may protrude from the box. It is possible, therefore, to ascertain whether the resultant flow of power is into or out of the box. If it is into the box, the total energy in the box must continue to increase, unless there is an escape route, for example, by conduction, convection, or radiation of heat; if the resultant flow of power is out of the box, then sustained running demands an input, for example, by air through a pipe to a compressed air motor in the box, or, for another example, by current to an electric motor in the box.

In the system shown in Fig. 2, $A_1B_1C_1$ are three spur gears running on shafts in Box No. 1. Gears A_1 and C_1 are connected by shafts to identical gears A_2 and C_2 in Box No. 2. Gears A_2 and C_2 mesh with a gear B_2 identical with B_1 but running in floating bearings to which an upward load *P* is applied. The tendency of such a load to rotate A_1 and C_1 in opposite directions is resisted by the meshing of $A_1B_1C_1$ and the shafts become twisted in opposite helices.

If the gears are set in motion by some external agent, applying torque at S, the shafts rotate in a common direction and so the flow of power along them are in opposite directions. Power may be said to "circulate" from A_1 to A_2 along the shaft, from A_2 to C_2 through the gears, from C_2 to C_1 along the shaft and back to A_1 through the gears.

A gear-shaft-bearing assembly such as that of $A_1B_1C_1$ cannot lead mechanical power into the system as a whole by means of the shafts, but it can—and does—induce power to leave the system in the form of heat by tooth friction, bearing friction, oil turbulence, and so on. Hence, the power flow into each box must be greater than the outflow, and the sum of the differences, representing the total power loss by heat dissipation from the two boxes, must be balanced by power input through S.

The power loss in each box may be only 1 per cent of the power input to it and the input at S may be only about 2 per cent of the power transmitted by each of the long shafts and by each train of gears. The power "circulating" round the system of gears and connecting shafts may thus be fifty times as great as the power input to the system through S.

This vision of "power circulation" fifty times as great as the input power may temporarily terrify the designer into imagining teeth being torn off gears and shafts twisted beyond recognition. His fears are groundless, however, as the loading of shafts and gears is proportional to the force *P* no matter how fast the shafts may run. (The dynamic loads set up by errors in the gear are neglected here.) Power circulation may cause difficulty, however, by causing excessive temperature rise associated with the frictional losses in the loaded teeth and bearings. In the system, Fig. 2, all the power input through S in the steady running condition is dissipated as heat from the boxes 1 and 2. This may result in excessive temperature rise of these boxes above atmosphere unless special provision is made for cooling them.

"Power circulation" is a convenient term, rather than a name for a mechanical phenomenon, and the gear designer need not be appalled by it. When all the tooth loads and tooth speeds are known, the power losses can be estimated. If they are found to be high in relation to the power output, it is to be considered whether the consequences are too serious to be accepted. The main questions are:

1. Whether the power loss is so expensive as to make the running of the plant an uneconomic operation.

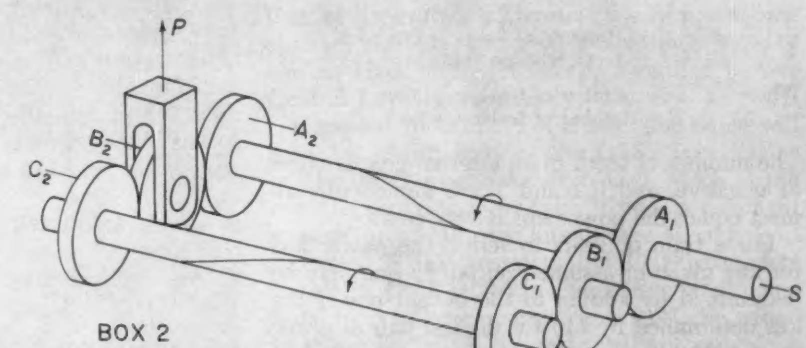

Fig. 2. Mechanism in which "power circulation" is large as compared to power input.

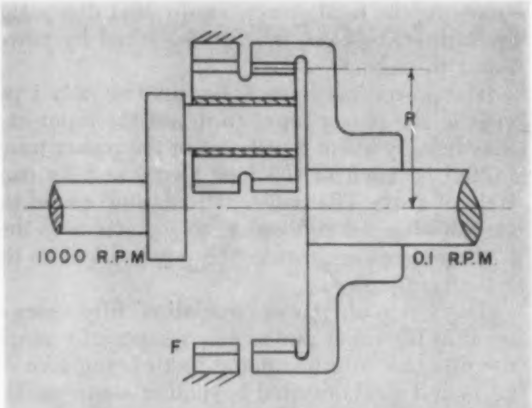

Fig. 3. Compound epicyclic gear train that provides 10,000 to 1 speed reduction.

2. Whether the dissipation of the power loss as heat or in other ways raises insurmountable difficulties in design.

Even if the answer is "No" to each question, the conscientious designer may still ask himself whether some alternative scheme might not meet all requirements with lower power loss.

Power Lost Through Friction Between Gear Teeth

The power lost by friction between the teeth of a pair of spur gears is proportional to the tooth load tangential to the pitch circles, to the speed of the teeth relative to the plane of the axes of the gears, and to the coefficient of friction between the teeth. It also depends on the lengths of the parts of the path of contact intercepted by the pitch point of the gears and by their outside diameter circles. For steel teeth of average proportions produced by American and British Standard cutters, the power loss is about

$$\frac{1}{6}\left(\frac{1}{t}+\frac{1}{T}\right) \times \text{(tangential load)} \times \text{(speed of teeth relative to plane of axes)} \qquad (1)$$

Where t = number of teeth in pinion
T = number of teeth in wheel

The number of teeth in an internal gear is taken as negative, and if t and T are numerically almost equal, the power loss is very small.

For a train of gears in series, the power loss for any given or assumed output torque may be determined by adding to the output power the loss determined by (1) for the last pair of gears, to give the power output by the next to the last pair of gears, and by repeating this process for every pair of gears. There is no difficulty about algebraic sign; the loss is positive everywhere.

Power Losses in Epicyclic Trains

The same principle may be used in connection with epicyclic gears. The tooth loads corresponding to a particular output torque are calculated on the assumption of zero tooth friction and there is rarely any difficulty about this. The tooth speed is calculated for every mesh-point. The various losses are calculated by (1) and so the input power (or powers) and hence the input torque (or torques) are determined.

Usually the input torque so calculated differs by only a few per cent from that calculated on the assumption of no tooth friction and the result may then be accepted. Otherwise the calculation needs to be carried out again in more detail, the originally assumed tooth load in any pair of gears being increased by an amount corresponding to the friction losses in succeeding gear pairs in the train. In some epicyclic trains it is not immediately obvious which are "succeeding gear pairs," but in such cases it is usually found that the estimated loss is about the same whether the calculator is correct on this point or not. This is so because the value of $\frac{1}{6}\left(\frac{1}{t}+\frac{1}{T}\right)$ is usually low, especially for a combination of a pinion and an internal gear.

Example: As a case of "power circulation" occurs in a marked degree, consideration may be given to the design of a train of parallel-shaft

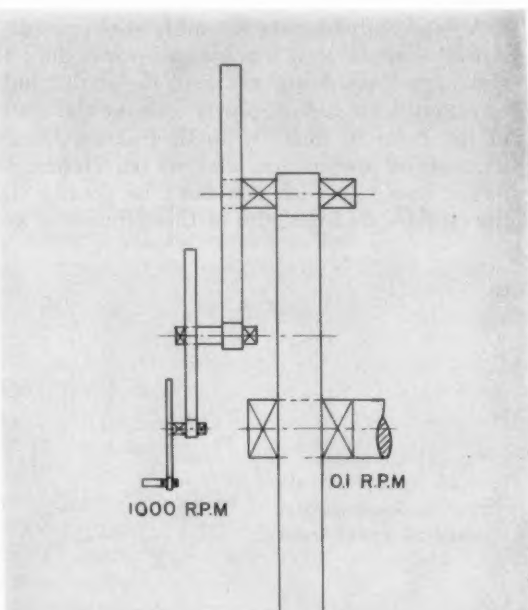

Fig. 4. Compound spur-gear train with a ratio of 10,000 to 1.

gears to reduce from 1000 to 0.1 rpm. This reduction may be achieved by four pairs of 10 to 1 ratio spur gears in series. Alternatively, a compound epicyclic gear train of four gears can be designed to give that ratio and in a much neater layout than is practicable for a quadruple train of spur gears.

Fig. 3 shows such a layout schematically. The planetary carrier rotates at 1000 rpm and so this is the speed of the plane of the axes of the meshing gears relative to the fixed gear and (very nearly) relative to the driven gear, of which the meshing radius is R. The power loss in each pair of gears is about

$$\frac{1}{6}\left(\frac{1}{t}-\frac{1}{T}\right) \times \text{tooth load} \times 1000 \times 2\pi R$$

If t is about 100 and T about 200, this becomes (for both pairs)

$2 \times \frac{1}{6} \times \frac{2\pi R}{200} \times 1000 \times \text{tooth load} = 10R \times \text{tooth}$ load (approximately). Output power = tooth load $\times\, 2\pi R \times 0.1 = 0.63R \times$ tooth load (approximately). The power loss is thus about sixteen times the power output and so the efficiency is about 6 per cent. If the output is low, even this low efficiency may be tolerable, but the dissipation of sixteen times the output in heat may raise difficult problems.

The alternative speed reduction train is shown in Fig. 4 to the same scale as Fig. 3 for a given output. It is clearly more cumbersome, but the power loss is unlikely to exceed 1.5 per cent of the output in each pair of gears and so the input required would be only about $1 + 4 \times 1.5/100 = 1.06$ times the output or only about one-fifteenth of that required by the layout in Fig. 3.

The big loss in the compound epicyclic train may be ascribed to "power circulation" in the gears but the term is not helpful in this connection. The essential fact is that the power output is low because the output gear has low speed relative to the structure of the driven machine that provides the reaction to the output torque and is assumed to be fixed in relation to the internal gear F, whereas the tooth-friction loss is high because the output gear has high speed relative to the common plane of its axis and that of the mating gear.

A train of spur gears, in series as shown in Fig. 4, avoids this defect because the tooth load is low on the high-speed gears and the over-all efficiency may exceed 94 per cent.

Avoiding Inefficient Gear Trains

Spur-Gear Trains: Very low efficiency occurs in spur-gear trains only where power is transmitted by a small number of gears with a velocity ratio of more than about 1000 to 1. Unless this condition applies, there is no need, in the preliminary stages of designing a gear train, to give any special consideration to the question of efficiency. As soon as a tentative layout has been achieved, it is a simple matter to estimate the probable power losses, and if they seem likely to be high, a revision of the scheme will probably have to be considered.

Epicyclic Trains: The combination of high tooth load and high meshing speed (in relation to output-shaft speed) is one that occurs only in epicyclic gear trains, but epicyclic gear designs in general are not appreciably more likely to have this combination than are the more conventional gear trains. What is important is to remember that spur gears, although highly efficient in normal trains, may be extremely inefficient in certain kinds of epicyclic gear-train arrangements.

Worm-Gears: In worm-gears of high ratio, the high tooth load applied to the worm-wheel teeth acts between surfaces that have the high sliding speed associated with the high rotational speed of the worm-shaft and power loss by friction tends to be high on that account.

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Soviet Technical Information Available

In an effort to provide American science and industry with access to translations of a large volume of technical information from the Soviet Union, the United States Department of Commerce is now operating a Foreign Technical Information Center as part of the Office of Technical Services, Business and Defense Services Administration.

Services of the Center include publication of abstracts of all articles appearing in 141 Soviet technical journals, translations of important sections of *Referativnvy Zhurnal* (the Russians' own abstract journal), and a semi-monthly review of various areas of Soviet science compiled by our Central Intelligence Agency.

Complete translations of articles and books will soon be distributed by the OTS. Translations will be listed in an abstract journal. Much of the material collected will be from government sources, principally the intelligence agencies. An estimated 50,000 abstracts and 10,000 complete translations will be made a year. Eventually, material from other sources is expected to be added to the collection. This program will provide a central point to which science and industry may look for comprehensive information on Soviet-bloc developments.

Rudder Shafts for Missiles Made in Halves and Welded

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IN BUILDING Navaho missiles, one of the difficult shop problems that had to be solved was to develop means of manufacturing the rudder shaft. In the first place, the designer was confronted with the necessity of selecting a material capable of withstanding high temperatures. The rudder post was located between the engines of the missile and radiant heat from the engines created temperatures up to 1500 degrees F. at the base of the rudder shaft. Shear loads up to 108,000 pounds were obtained in flight.

When selecting a material for any particular application, several factors must be taken into consideration, such as the physical and mechanical properties required for the service intended, availability, weldability, and machinability.

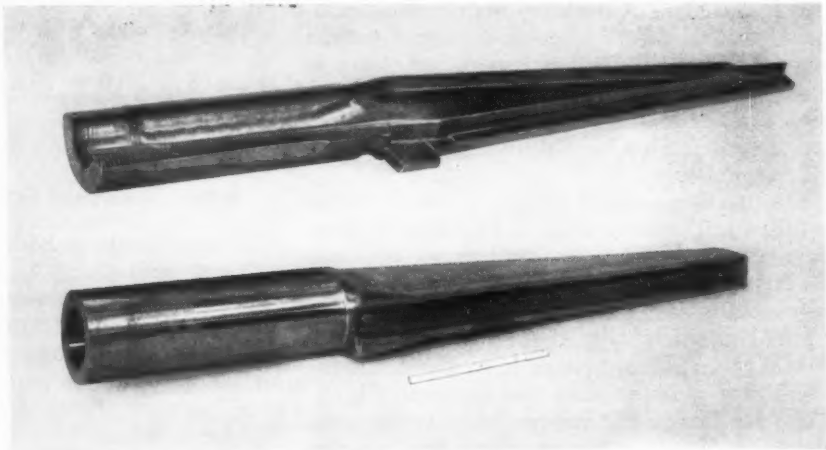
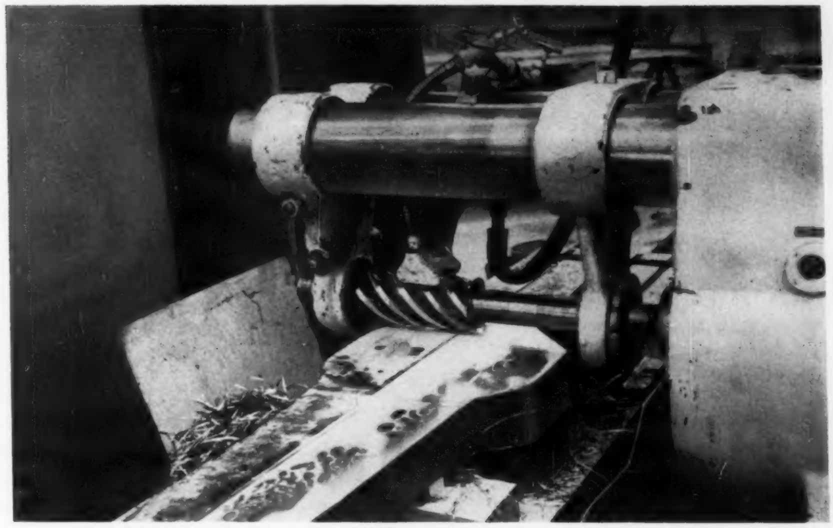


Fig. 1. (Right) Two Inconel "X" forgings machined as shown in the top view were welded together to form the rudder shaft for Navaho missiles.

Fig. 2. (Left) Rough-forging from which a rudder-shaft half is produced, a partially finished half, a completely finished half, and a welded shaft, reading from top to bottom.

Fig. 3. The rudder-shaft forgings were slab-milled at the beginning of the machining operation.



Inconel "X" was selected as the material from which the rudder shafts were to be made because this alloy has good physical and mechanical properties at high temperatures. Also, it is highly resistant to corrosion and oxidation. Another point in its favor was that the alloy had already given good high-temperature service when used for components of jet and gas turbine engines.

A further design requirement was that the shaft should be hollow to reduce weight. It was decided that the preferred procedure in making the rudder shaft was to use two forgings, machine them with the required pockets and cavities, and then to weld them together to form a complete component.

Half of a rudder shaft is seen at the top in Fig. 1, and a welded shaft at the bottom, in this illustration. The complete rudder shaft was 51 inches long, 12 inches in maximum width, and 2 1/8 inches wide at the narrow end. Sections were as little as 1/4 inch in thickness. In Fig. 2 a rough-forging is seen at the top, then two machined halves, and at the bottom, a complete rudder shaft made up by placing one half on top of another, and welding them together.

In the machining procedure, the first step was to slab-mill two forgings at a time on a conventional, horizontal milling machine as seen in Fig. 3. Then, the two forgings were mounted on the vertical platen of a Keller duplicating machine in Fig. 4 for contour-milling the various cavities. All surfaces were rough- and finish-machined with the exception of the tubular portion which was only rough-milled by this equipment. The outside surfaces of the forgings were also rough-machined.

The surfaces which were to be mated to form the weld joint were finished with a "J" scarf so that 100 per cent penetration could readily be obtained in the later welding operations. In milling on the Keller machine, a small amount of stock was left on all external surfaces and inside of the tubular section for "cleaning up" after welding and heat-treating.

The master pattern employed on the Keller machine to guide the cutter over the various configurations of the work is seen mounted on the vertical table above the two forgings. This master was made of an epoxy-base plastic material. Since Inconel "X" is comparatively difficult to machine, a low cutting speed was used, and the cutters supplied with a liberal flow of coolant. Six-fluted end-mills were employed for roughing. Fig. 5 shows a close-up view of one of the rudder-shaft halves, and the milling cutter can be readily observed. The grooves left by the milling cutter in this operation were later removed by an abrasive belt grinder. At the end of that operation, the appearance of the cavity of each half was as seen in the top view of Fig. 1.

Since the rudder shafts were heat-treated after welding, it was necessary that the filler material used in welding be of the same chemical analysis as the base metal, in order to obtain full heat-treat properties in the weld. The inert-gas, shielded tungsten arc process was employed for this operation.

In the welding procedure, two forged and machined halves were clamped together and tack-welded. This assembly was then preheated to 400 degrees F. and the root welded by making a series of passes with the welding head. Care

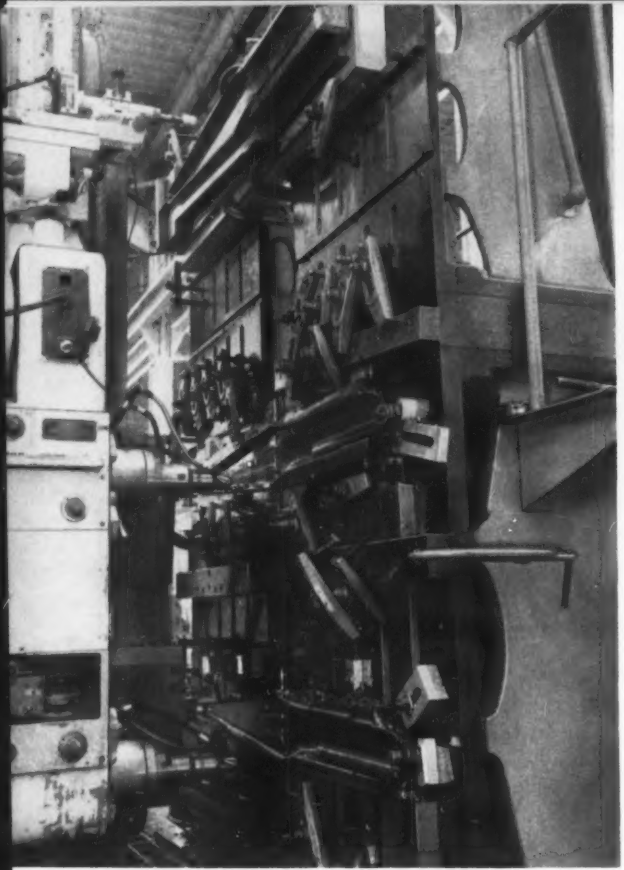


Fig. 4. Two rudder-shaft halves, later to be welded together, are here seen being milled simultaneously on a Keller automatic, tracer-controlled milling machine.

was taken to obtain 100 per cent penetration. The deposit laid in each pass was sand-blasted and carefully checked for discontinuities by dye-penetrant and radiographic inspection methods. Discontinuities were removed by grinding, and the work was then re-welded at these points prior to making subsequent welding passes. The stringer-bead welding technique was employed to minimize the generation of excessive heat. In addition, this process reduced the chances of cracks developing.

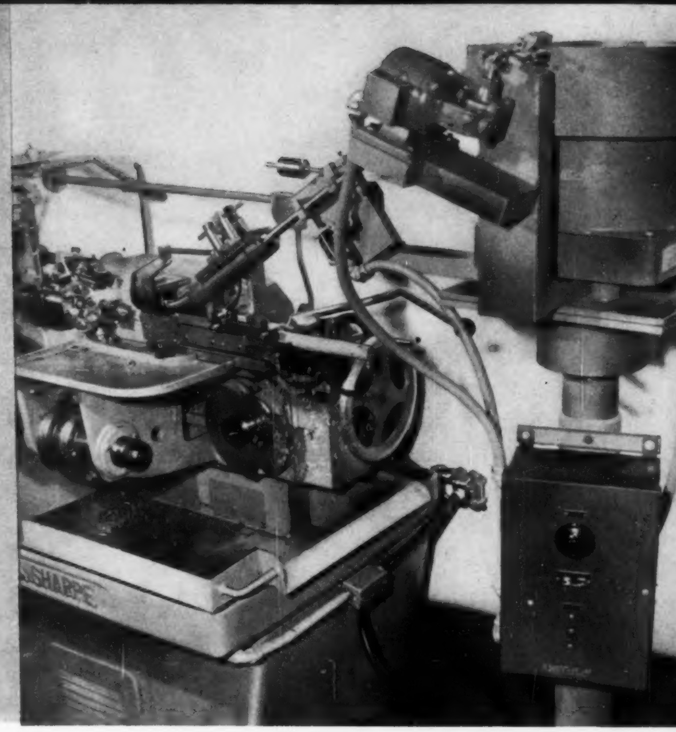
The heat-treatment was as follows:

1. After forging and before welding, the forgings were annealed by heating rapidly to 1900 degrees F., holding at this temperature for approximately one-half hour and air-cooling as rapidly as possible to room temperature.
2. After welding and before final machining, the rudder shafts were heated to 2100 degrees F. within plus or minus 25 degrees F., holding at this temperature for fifteen to thirty minutes. Cooled to room temperature.
3. Heated to 1550 degrees F. within plus or minus 25 degrees F.; held at temperature for twenty-four hours. Air-cooled to room temperature within two hours.
4. Heated to 1300 degrees F. within plus or minus 25 degrees F.; held at temperature for twenty hours.
5. Removed from furnace and air-cooled to room temperature. After this heat-treatment, the assembled rudder shafts were finish-machined by milling the rectangular section, and the tubular section was bored internally and externally on a lathe to specified dimensions.

The welds were 100 per cent radiographically inspected. This close examination was necessary because of the high loads at high temperatures to which the rudder shafts were subjected in service.

Fig. 5. Close-up view of the machine in Fig. 4 showing the application of a round-nose end-mill to one of the rudder-shaft forgings.

FROM HOPPER TO TURRET TO COLLET



A new way to load and unload automatics for secondary operations

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A VIBRATORY-FEED HOPPER for secondary operations on Brown & Sharpe automatic screw machines uses one of the turret stations as a "transfer agent."

The usual practice has been to locate the hopper feed near the spindle. Parts flow down a chute attached to the machine frame, dropping onto a carrier mounted on the front tool-slide. This slide moves in and out under the control of a cam. For the loading, the slide dwells with the carrier in front of the collet, on the rise of the cam, and a bar in the turret pushes the part out of the carrier and into the open collet. One disadvantage of this arrangement is that a significant number of cam spaces must be allowed for the mechanism to function, with an attendant increase in cycle time. Further, no form tools can be set up on the front slide, because of the presence of the part-carrier.

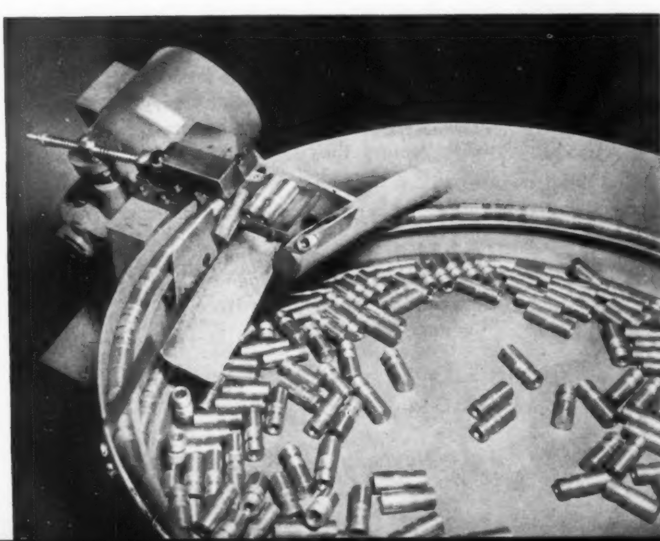


Fig. 1. The vibratory-feed hopper runs intermittently, directing properly oriented parts into a tubular chute.

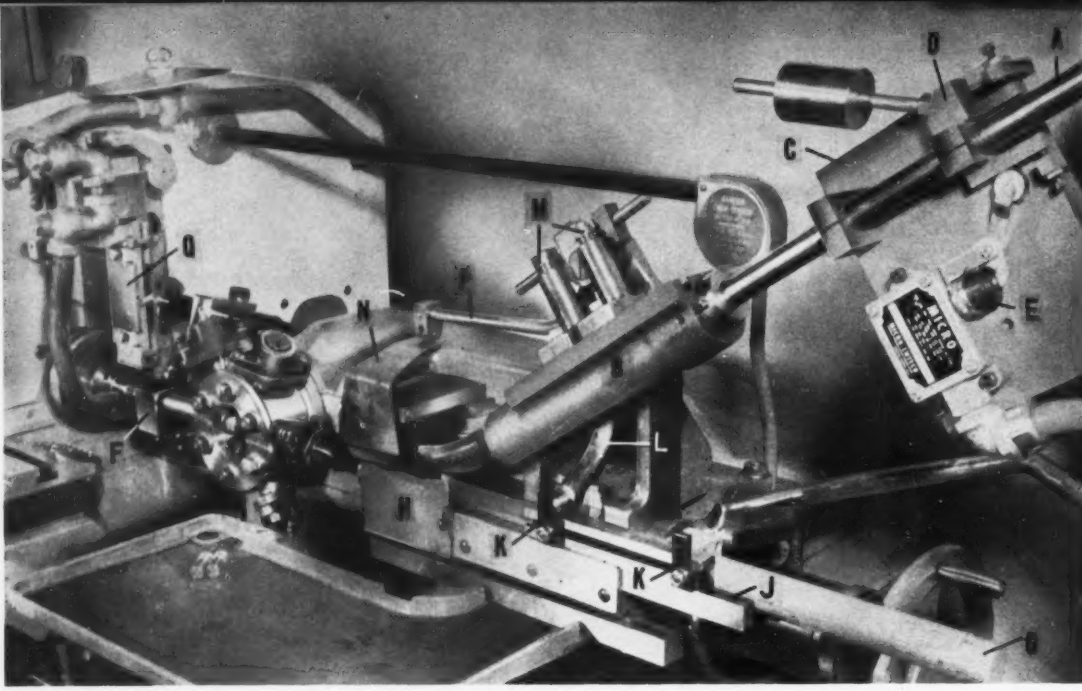
The Skinner Chuck Co.'s Electric Valve Division is one of the first users of a new B & S feed that eliminates these disadvantages. Recently, this feed was installed on the No. 2 automatic screw machine seen in the heading illustration. Its principal element is a vibratory hopper, which, unlike the conventional feed, is located at the foot end of the machine.

A close-up view of the feed bowl appears in Fig. 1. Loaded in volume, the parts travel up a spiral track in the wall of the bowl. At the end of the track, a sorter rejects parts improperly oriented, causing them to return to the bowl. Accepted parts enter a tubular chute.

Part progression from hopper to collet can be followed in Fig. 2. The tubular chute *A*, down which the parts move from the bowl, extends to body *B*. This chute is located against plate *C*, which is fixed to a brace extending from the hopper pedestal.

The chute has a slight amount of flexure. When it is filled with parts it causes yoke *D* to drop slightly, operating micro-switch *E*, which shuts off the motor of the vibratory hopper feed. Then, as the parts vacate the chute, the yoke moves up, again operating the switch, and more parts soon fill the chute.

One of the turret stations is tooled with a block *F* containing a spring-loaded bushing which serves to transfer the work. When this station is indexed to rearmost position, a cam-operated micro-switch causes a plunger in air



cylinder G to push a work-piece from trough *H* into the bushing. Then, when this station is indexed 180 degrees, the work-piece is thrust into the collet on the machine spindle.

To meter the parts from body *B* to trough *H*, the air cylinder also causes slide *J* to reciprocate. Dogs *K* on the slide pivot lever *L*, in turn alternately operating two plungers *M*. The bottoms of these plungers act as gates in the path of the work-pieces, and are designed to pass only one work-piece for each back and forth movement of the slide. Lever *L* also operates bracket *N* through rod *P*. The bracket receives the work-piece from the bottom of the body, then swings forward to deposit it in the trough.

Once the secondary operation sequence on this part has been completed it is important that it be removed from the machine with care, since the slightest nicking would ruin it. For that reason, a feeding-out mechanism designed by B & S for Skinner was installed to take the finished part from the collet.

As can be seen in Fig. 3, a small magazine *Q* was fastened to the vertical cross-slide. This magazine is similar to a rifle clip. The finished part is unloaded into the bottom of the magazine, which is first brought into receiving position by the action of the vertical cross-slide cam. When the cross-slide returns to top position, the part uppermost in the magazine is discharged into a stacking tray. Meanwhile, block *F* transfers the next part to the collet.

While the new loading arrangement has reduced cycle time for the secondary operations on the valve part from twenty-five seconds to twenty-two and one-half seconds, the main saving lies in the higher efficiency of the fully automatic vibratory-feed hopper. The usual interference allowance for conventional chute hand-loading is eliminated.

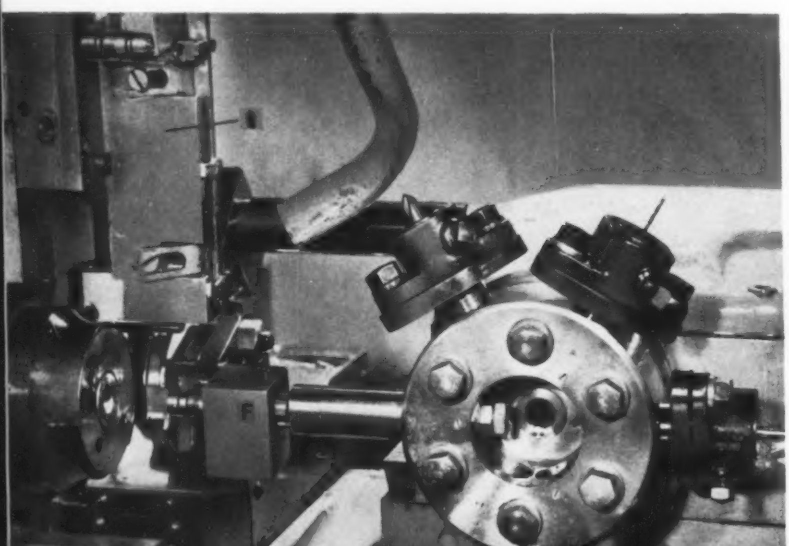
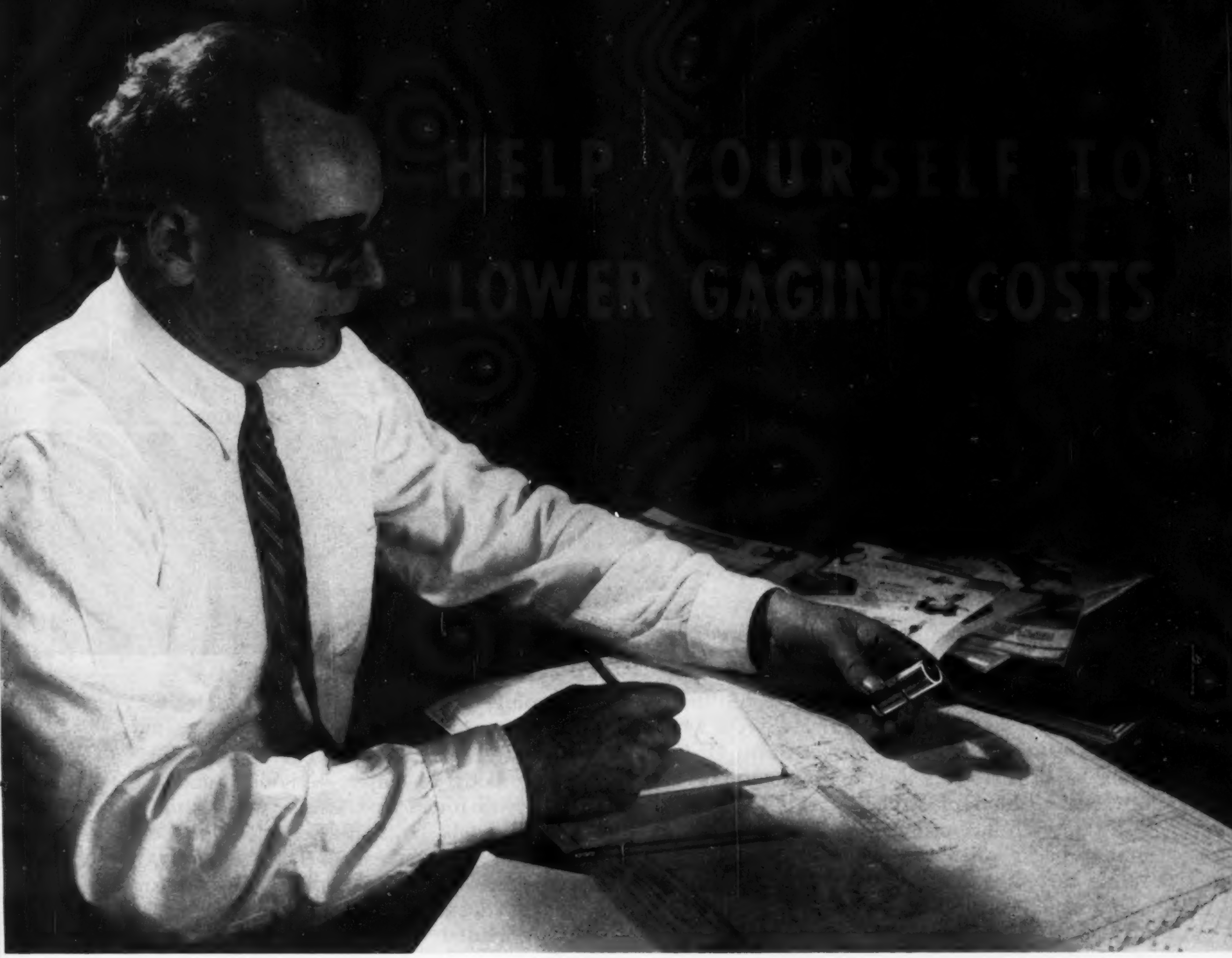


Fig. 2. (Above) Air cylinder (G) operates a plunger which loads the work-piece in the turret station, and, through two plungers (M), meters the work-pieces to trough (H).

Fig. 3. (Left) Finished parts are unloaded into magazine (Q), then travel upward. Open spindle collet is about to receive next part from block (F).



HELP YOURSELF TO LOWER GAGING COSTS

When buying gages, the most important consideration is the amount of money they will save. The economic factors depend largely on how and where the gages will be used—this, in turn, determining the type of units to acquire. Examples are given of how two plants of different sizes obtained greater rewards from gaging than had been contemplated.

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MANAGEMENT today is taking a hard look at costs in every area of manufacturing activity. Although inspection is a necessary part of production—not merely an indirect or non-productive cost—it usually receives closer examination than other phases of the manufacturing process. There is nothing wrong with this cost-conscious attitude of management: it is good business to get top value for every dollar spent.

There are a great many variables involved in selecting the most suitable gages for inspection. Cost considerations extend far beyond the initial outlay for measuring equipment. In weighing eventual needs against company policy, methods of processing, nature of the part, and the many other factors involved, the choice of a gaging method is seldom an obvious one. Calling upon an experienced gage manufacturer for advice and assistance can often lead to more effective gaging at lower cost than originally contemplated.

A case in point concerns a medium-sized plant employing about five hundred people. Because this company was engaged in the manufacture of a complete assembly which was its own product,

Fig. 1. Small dial indicating gages are being used directly at the machine to control part quality at each phase of production.

individual components were not subjected to the rigid inspections that are generally required when parts are produced on a contract basis. On the other hand, there was the problem of supplying interchangeable replacement parts.

No process inspection was used except for initial checks when the machines were set up. While this situation is unusual, it does happen occasionally. The inevitable result was that a great deal of fitting and selective assembly was required to complete the end product. It was the goal of the company that some form of inspection procedure be adopted so that only dimensionally satisfactory parts would be produced, thereby cutting scrap losses and reducing excessively high assembly costs.

Complete Final Inspection Considered

As a first step, the entire operation was reviewed by both a company engineer and the author. It was found that, aside from standard items such as nuts, bolts, and screws, there were twelve major components in the assembly. All required close dimensional control. A gage setup for the final inspection of each of these parts could be provided, thereby decreasing, and possibly eliminating, the possibility of defective parts continuing into assembly. However, as most of the parts had several critical dimensions, efficient final inspection would need costly equipment.

Investigating further, most of the parts pass through several departments before they are

Fig. 2. Arnold grinding gage keeps a close control over grinding operation on pinion shaft. Reduction in diameter is indicated on dial.

completed. Lead time, considering the number of operations involved, averaged three to four weeks from the raw-material stage to the finished item. It is obvious that inspection just prior to assembly would reveal one of two conditions: either the parts are acceptable, or they are out of tolerance. If the parts are running out of tolerance, the operation concerned might have taken place during the previous three or four weeks. Had the cause of rejection been discovered on the spot, the part could have been scrapped, all subsequent machining costs eliminated, and the condition corrected.

Another factor to be dealt with when considering a final inspection program is long-range cost. With an average of four critical dimensions on each of the twelve parts concerned, and an annual production rate of 15,000 parts, there are approximately 720,000 dimensions to be measured each year. Inspection cost in this case goes far beyond the monetary outlay for gages: it must include the cost of using the equipment.

To arrive at some concrete figures, a small pinion shaft was selected for detailed study. Four diameters on the shaft were held to close tolerances, the pitch line of the pinion teeth was critical, and the keyway had to be machined to a definite relationship with the pinion teeth.

One approach to quality control of this part would be a final inspection gage designed to check all four diameters simultaneously, check the pitch line of the pinion teeth, and check the orientation of the keyway. Considering the quantity and tolerances involved, a tool to do this job would cost approximately $2000. With an efficient inspector handling three to four pieces per minute, from sixty to seventy hours per year would be consumed in checking this particular part. At an hourly departmental cost rate of $5, annual inspection cost would range from $300 to $400, or 2 to 3 cents per part.

An important point here is that this inspection procedure could not be expected to reveal much more than was already known. Defective parts were being sorted out at assembly, not because they did not fall within blueprint tolerances, but because they did not fit. Another major point to be considered is that nothing will have been done to correct the offending production step.

Process Inspection Evaluated

An analysis of pinion-shaft control was then made in the light of step-by-step process inspection. The first operation, machining of the rough blank, involved no measuring equipment. Blanks were being produced sufficiently close so that no rigid control was considered necessary. If desired, however, an indicating snap gage, such as that shown in Fig. 1, could be used by the operator.

During the second operation the four diameters were ground on centers. Arnold grinding gages (Fig. 2) could be installed and used together with indicating snap gages for periodic quality-control inspection. The cost of this equipment would be approximately $500, but properly used, it would insure that no out-of-tolerance parts left the grinding department.

A reliable hand gage, shown in Fig. 3, and used in the gear-cutting department, would provide a constant check on this operation at a probable cost of $200. The next, and last, critical item is the relationship of the keyway to the pinion teeth. A slight modification of the milling fixture used for cutting the keyway would, for all practical purposes, eliminate the need for a gage. If a

Fig. 3. Portable gear gage equipped with dial indicator is being used to check pitch diameter before work leaves the gear-cutting department.

gage were desired, however, it could be provided at a cost of about $200.

What has been accomplished by approaching the inspection problem at the individual machines? First, the need for final inspection has been eliminated. Second, equipment costs have been reduced from $2000 on a final inspection basis to approximately $1000 on a process-control basis. Finally, nothing has been added to the cost of manufacture.

Large Plants Face the Same Decision

Not only small- and medium-sized plants face the problem of selecting gaging systems. One instance concerns a large corporation having well-established quality control and inspection methods. It had subcontracted to produce small parts on which three dimensions had to be measured. Production requirements were high, tolerances were close, and 100 per cent inspection was essential.

The quotation for inspection costs listed approximately $3500 for equipment and $200,000 for the services of twenty inspectors—ten on each of two shifts—at a departmental cost rate of $5 per hour. (It should be noted here that this estimate proved to be high.)

One factor influencing in-process gaging costs was that, although the parts were relatively easy to inspect, two people had to be at the machine at all times. Another factor was one that influenced the type of gage or gages to be selected: Equipment costs had to be prorated over the immediate run because there was no assurance that the prime contractor would retain the same design after the order was completed.

The problem boiled down to an evaluation of four methods of measurement: (1) micrometers, calipers, and other simple measuring tools (this had apparently been considered in the original estimate); (2) simple indicating gages, Fig. 3; (3) more complex gages using indicating lights, Fig. 4; and (4) completely automatic gaging equipment.

A final decision between the four possible systems was based on a total-cost figure combining original-equipment cost and annual inspection cost. This breakdown is shown in the accompanying table. An analysis of these figures indicated that method No. 3 presented the most desirable approach. Aside from cost, this method was also desirable from a functional aspect because the signal lights, set accurately within job tolerances, would greatly reduce the incidence of human error.

Some Basic Factors in Selecting a Gaging Program

When considering the number of variables involved in establishing a gaging program, it can be realized that they cover a broad field and that generalities are, for the most part, useless in outlining an approach to any specific problem. Of fundamental importance is close cooperation between plant management and an experienced gage specialist. However, a few considerations basic to any gaging problem are as follows:

1. Gages to be used must be functionally capable of doing the intended job. This pre-supposes that the accuracy, or sensitivity, of the gages bears a reasonable relationship to job tolerances. If, for example, the job tolerance is on the order of 0.005 inch, the gage should be sensitive to at least 0.0005 inch. By the same token, a gage more accurate than is required can represent an initial over-investment. Also, such a gage might

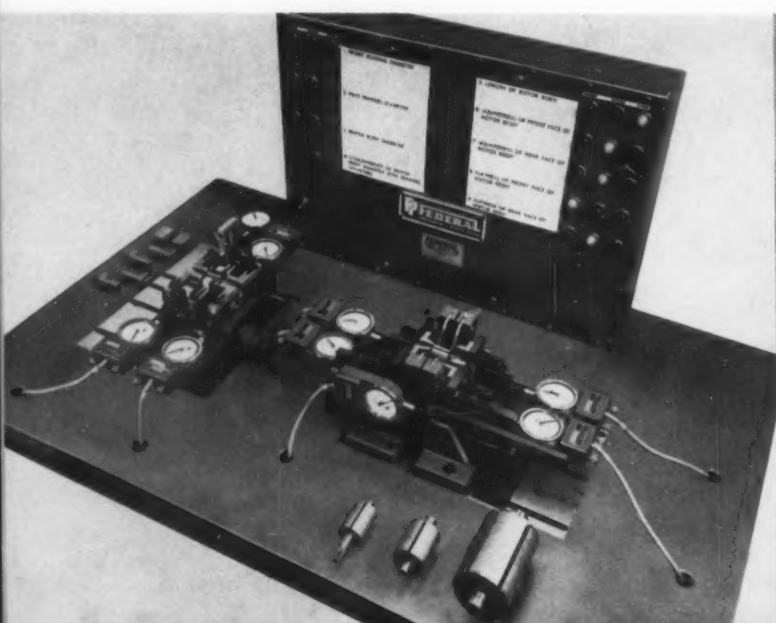

Fig. 4. Multiple-dimension gage setup simultaneously checks several dimensions on machined rotor. Panel lights indicate whether each dimension is under, over, or within tolerances.

Cost Breakdown—A Comparison of Four Inspection Systems

	Inspection Methods			
	(1) Simple Measuring Tools	(2) Simple Indicating Gages	(3) Complex Gages, Indicating Lights	(4) Automatic Gaging Equipment
Original Equipment Cost	$2500	$4500	$8000	$25,000
Number of Inspectors Required	10*	6	3	2†
Annual Inspection Cost‡	$100,000	$60,000	$30,000	$20,000
Total Cost for one Year	$102,500	$64,500	$38,000	$45,000

* Ten men per day as compared to twenty men per day in original quotation.
† Because of other duties, two men are required even though automatic gages are employed.
‡ Based on a $5 hourly departmental cost rate.

be affected by irrelevant conditions of the workpieces, thus confusing the measurement and slowing up the inspection procedure.

2. Cost of using and maintaining the gages is just as important as initial equipment cost and should never be overlooked.

3. In general, a gage that can be reset to a master, thus automatically compensating for wear, is more desirable than a gage that will lose accuracy through continued usage.

4. It is usually desirable to perform a gaging operation at the point of processing rather than at a remote inspection station. It is also desirable to keep abreast of the operation rather than to allow unchecked parts to accumulate.

5. Wherever possible, the human element should be discounted as a factor in the accuracy of inspection.

6. Inspection costs normally increase sharply as job accuracy becomes greater. Before settling on a gaging setup for parts requiring extremely close tolerances, it is a good practice to verify the need for such accuracy.

7. In considering the cost of gages, their possible application to future components should not be overlooked. A fixed, single-purpose gage may be useless if a design change occurs or when an order is completed. By contrast, an indicating type gage frequently can be modified for another application at little cost.

Perhaps the biggest step management can take toward a better product at lower cost is to give broader responsibility to inspection and quality-control personnel. Their special interests should extend their activities into other phases of manufacturing that affect product quality levels.

Tolerance Relationships in Hole Dimensioning

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In establishing tolerances for a hole, engineers are often unaware that a mathematical relationship exists between the tolerances on the various basic dimensions. Conveniently, however, simple and easily remembered equations define this interdependence.

A typical example of a hole located from data by true-position dimensioning is shown at X in the accompanying illustration. Dimensions M_1 and M_2 are basic, and the tolerance on the hole location is given by a note. The symbol MMC (maximum material condition) is used in the positional tolerance to indicate that the limits specified are only for those parts at the MMC, and that other parts are permitted an additional departure from the theoretical location. This method of dimensioning arises from the use of fixed type inspection gages which simulate the least favorable condition of assembly. Although the practice has been followed for a long time in manufacturing, it has now been recognized and condoned in the drafting standards of the American Society of Mechanical Engineers and the Society of Automotive Engineers.

The diameter of the hole is inspected with a "Go" and "Not-Go" plug gage, and the location is checked by the fixed gage *G*. The least favorable condition of assembly with a similar part

occurs when the hole as seen in View Y has the smallest allowable diameter H and is located at the greatest permissible distance m from the true position. Such a part is in full accord with the drawing and will pass inspection with the gage.

The relationship that exists between the minimum hole diameter H, the positional tolerance m, and the diameter B of the gage pin is given by the equation:

$$B = H - 2m \tag{1}$$

In addition, dimension B is the maximum permissible diameter of the assembly bolt.

It is noteworthy that parts not at the MMC (those with larger diameter holes), and having centers further from the true position than m, will also pass inspection with such a gage. A part with a hole of maximum diameter $H + h$ is shown at Z. The center of this part is removed from the true position by the amount m', where

$$m' = m + \frac{h}{2} \tag{2}$$

Although such a part is not in agreement with the drawing, no difficulty arises in assembly.

All the dimensions of the part cannot be chosen arbitrarily, but must be in accordance with Equations (1) and (2). If hole center dimensions M_1 and M_2, the maximum diameter B of assembly bolt, hole tolerance h, and the maximum permissible radius of variation m' in the location of a maximum diameter hole are known, the minimum hole diameter H and tolerance m on center distance are easily determined.

Example: Two parts of the type illustrated are to be assembled with bolts 0.750 inch in diameter, maximum. Maximum variation m' in the location of the holes on the actual parts is to be 0.003 inch and tolerance on hole diameters is 0.004 inch. Find the required values for H and m.

Solution: Using Equation (2)

$$m = m' - \frac{h}{2}$$

$$= 0.003 - \frac{0.004}{2} = 0.001 \text{ inch}$$

Substituting this value in Equation (1)

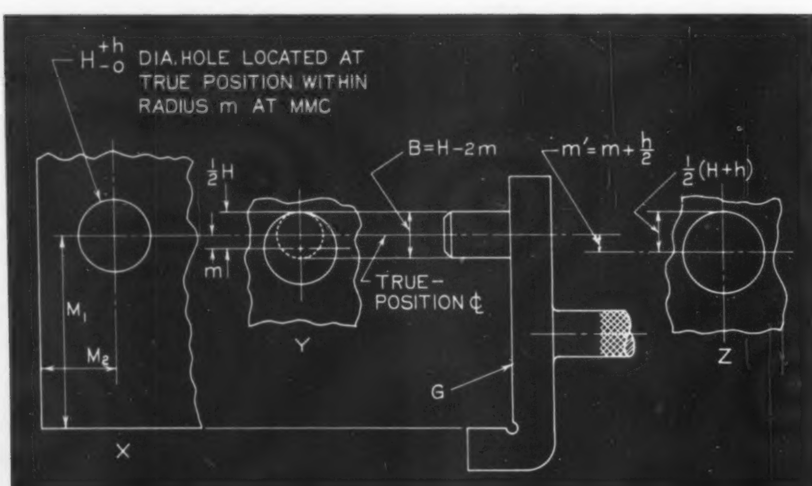
$$H = B + 2m$$

$$= 0.750 + 2 \times 0.001 = 0.752 \text{ inch}$$

Although the illustration shows only a downward deviation in position, the location of the hole can vary in any direction. Tolerance m, in effect, defines an imaginary cylindrical surface of diameter $H - 2m$. Holes that pass inspection with the gage must have sides which do not intersect or lie within this surface. Actually, the part could be dimensioned equally well in the conventional manner. With m determined as above, the notation following H would be omitted and the hole location dimensioned as $M_1 \pm m$ and $M_2 \pm m$.

The inspection of two holes with a fixed gage having two pins can be similarly handled. It is only necessary to set a datum at the midpoint between the holes and proceed in the same manner. Sometimes the actual spacing of the holes must be held to the tolerance m of the drawing. For example, the hole centers for the mounting of gears would not permit the excess variation resulting from the use of a fixed type gage. In such cases, MMC notation should be omitted and the tolerance marked "regardless of hole size."

True-position dimensioning can be applied to other features as well as to holes. The hole illustrated could be replaced by a slot without changing the results. A modification would, of course, be made in the gage. Gage-maker's tolerance and gage wear have been neglected.



True-position dimensioning of a hole to be inspected with a fixed type location gage and a "Go" and "Not-Go" plug gage is seen at (X). Minimum and maximum diameter holes that pass such inspection are indicated at (Y) and (Z), respectively.

CRUSH-TRUING SPEEDS HYATT TOOLMAKING

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PROFILES on circular shaving tools are now obtained by plunge grinding with crush-trued wheels, at the Clark, N. J., plant of General Motors' Hyatt Bearing Division. The technique, requiring as little as twelve minutes, replaces six to eight hours of tedious lathe work. Added to the remarkable slash in toolmaking time is the fact that the ground tool has a more accurate profile. This is one of the first toolroom applications of crush-truing, which has long been associated with large-scale plunge-grinding operations.

Hyatt is a major supplier of tapered, straight, and barrel-shaped roller bearings for autos, trucks, and trains. The races of the cups and cones of these bearings are produced by the shaving tools in large quantities on automatic bar machines.

In Fig. 1 are shown two views of a typical tool (left and center), and an enlargement of its profile (right). The profile is ground completely around the periphery, which is circular except for a large cutout milled at one point to create a cutting face. A central hole in the tool provides the means of supporting it on an arbor. When dull, the cutting face is sharpened, and the arbor is then rotated slightly to bring the face onto the center line of the machine spindle. Two smaller holes receive screws which prevent the tool from turning in its holder. Tool material is a 12 per cent cobalt high-speed steel, such as Vasco Supreme, and hardened to 62 to 64 Rockwell C.

To plunge grind the profile into the tool, the grinding-wheel periphery must, of course, be trued to the reverse of the profile. This is done by crushing the wheel with a roll having a periphery identical in profile to that desired in the shaving tool. The relationship between these various elements can be seen in Fig. 2. Roll *A*, made from blank *B* (by a method to be explained), crush-trues its profile in reverse into grinding wheel *C*. The wheel, in turn, plunge grinds tool blank *D*, to obtain the profile of the finished shaving tool *E*. On the automatic bar machine, the tool forms the race of the roller-bearing cone *F*.

There is a "bank" of three rolls and a separate grinding wheel maintained for each size and shape of shaving tool in production. When a new tool design is ordered, the original, or master, roll is made directly from the drawing on a pantograph-controlled grinder. Profiles can then be rapidly reproduced in the cylindrical blanks of the other two (working) rolls by plunge grind-

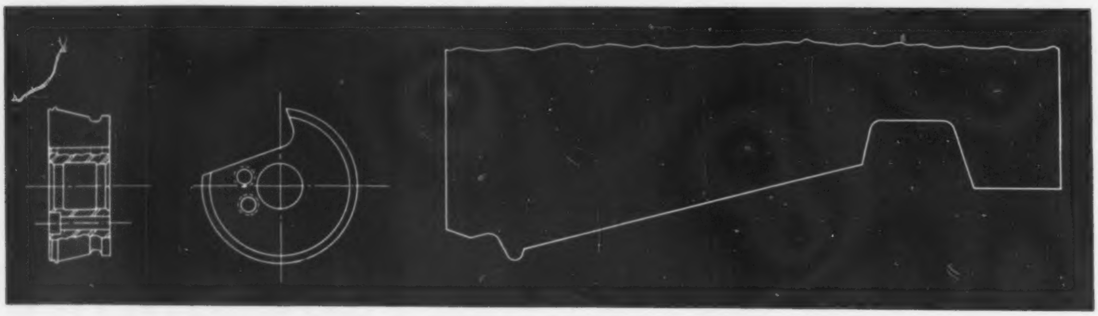


Fig. 1. The profile of this circular shaving tool (shown enlarged at right) is produced by plunge grinding with a crush-trued wheel.

ing in the same way the shaving tools themselves are processed later.

(Sometimes a profile is such as to require a drastic initial crushing of a new wheel, so that the profile of the master roll may lose its tolerance even before the wheel truing is completed. This eventuality usually can be anticipated from past experience, so two of the three rolls in the bank will originally be profiled on the form grinder. After the first roll crushes the wheel, the second roll is substituted and crushes the wheel further to remove any error. The wheel is then ready to correct the profile of the first roll, as well as to plunge grind the third roll.)

With all three rolls completed and the wheel crush-trued, the plunge grinding of the shaving tools can proceed. One of the working rolls is left in the crush-truing device of the plunge grinder.

The shaving tools are brought to the grinder in lots of six pieces. To speed processing, the tools generally are plunge ground oversize while still soft (Brinell 218 to 220), then hardened and returned for finish-grinding. In previous operations, the central hole is bored in the tool blanks, the sides finished on a surface grinder to bring the tool to proper width, and the outside diameter brought close to size by a straight turning cut on a lathe.

In the heading illustration can be seen a close-up view of the plunge grinding in progress. The machine is a Sheffield No. 109 annular form grinder. The wheel-head, located in back of the work, feeds forward automatically to a pre-set depth, then retracts. The tool blank is mounted on an arbor which is held between centers and is driven by a separate work-head.

Wheels are 150 grit silicon carbide, vitrified bond, and plunge grind at a speed of 5500 to 6500 surface feet per minute. They have a 14-inch outside diameter (when new) and a 5-inch hole. Wheel width is slightly more than that of the profile, and can be a maximum of 2 inches. On the

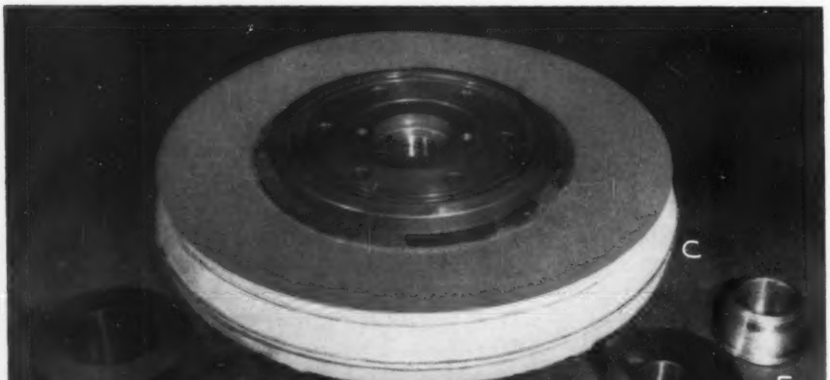
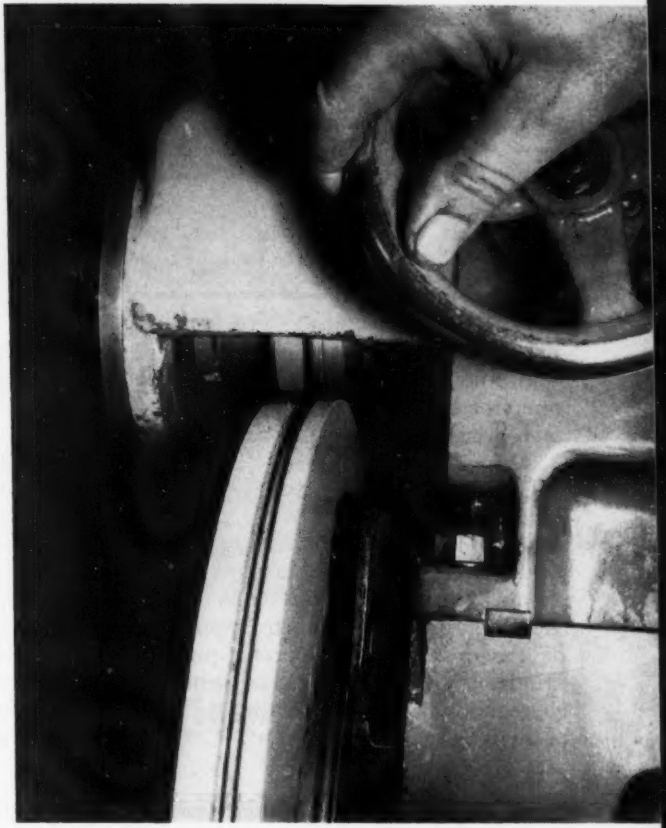


Fig. 2. Wheel (C) is crush-trued by roll (A), and plunge grinds tool (E). Profile of cone (F), in turn, is obtained on bar automatic with tool (E).

Fig. 3. When the wheel needs crush-truing, the roll slide is fed downward. In operation, slide feed is motorized, and roll revolves on contact with wheel.



average, six tools can be ground before the periphery of the wheel must again be crush-trued to maintain the tolerance on the profile.

When crushing is necessary, wheel speed is reduced to 250 surface feet per minute, and the wheel guard is raised to permit access to the roll, which is mounted above the wheel, as can be seen in Fig. 3. There is a small motor in the crush-truing device which feeds the roll slide down automatically. The roll, free on its shaft, starts revolving when it contacts the grinding wheel.

Crushing action starts as the roll slide continues to feed to a pre-set stop. The cycle ends with the automatic reversal of the slide. A heavy-base sulphur oil is used for both the plunge grinding and the crushing.

As stated previously, it is of course necessary to obtain the profile in a new master roll by some means other than crushing. This is done on the Sheffield No. 122 Micro-Form grinder illustrated in Fig. 4. The machine grinds directly from a 50 to 1 layout of the tool, made on Vellumoid film.

By following the lines on the drawing from point to point with a pantograph stylus, cross-hairs in a viewing screen and scope move exactly according to the profile to be ground. The hardened blank for the master roll is supported between centers on a powered circular-grinding

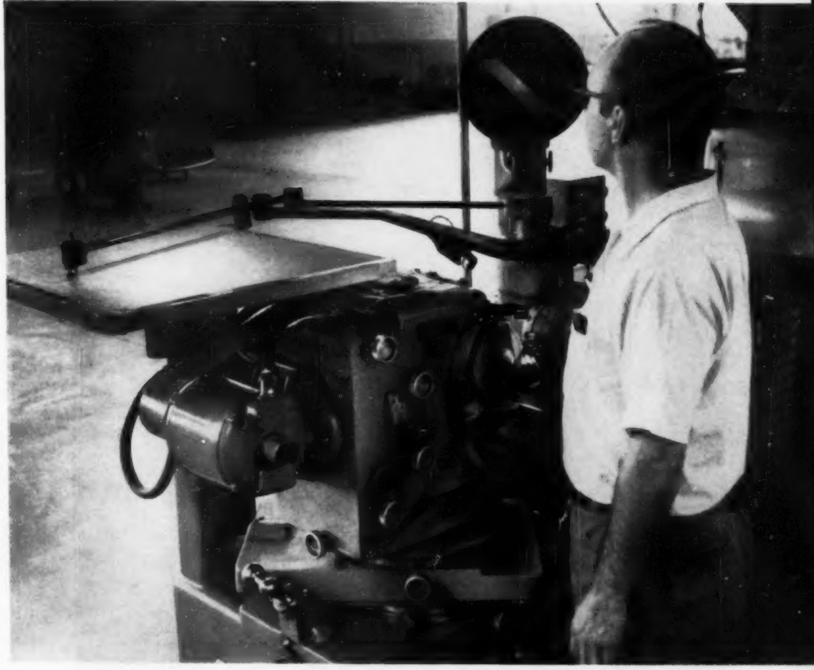


Fig. 4. When a new design of shaving tool is ordered, the initial machining produces the profile of the master roll from a Vellumoid drawing on this pantograph-controlled grinder.

The Toolmaking Procedure:

1. Produce master roll profile from Vellumoid drawing on pantograph-controlled grinder.
2. Crush profile of master roll into wheel of plunge grinder.
3. Plunge grind profile of working rolls.
4. Plunge grind profile of circular shaving tools, using a working roll to crush-true grinding wheel periodically.

attachment. The pantograph table is integral with the wheel-head, which is moved by the operator in coordinate directions. An 80-grit, 6-inch grinding wheel, 3/16-inch wide, running at 3500 rpm, is used.

Complementing the two Sheffield machines in Hyatt's shaving-tool grinding setup is the Jones & Lamson optical comparator seen in Fig. 5. After the plunge grinding, each shaving tool is inspected on the equipment while still on its arbor. When the profile is seen to approach the limits on the drawing, the operator puts the plunge grinder through another crush-truing cycle. The comparator is also used to inspect the condition of the rolls themselves.

Fig. 5. This optical comparator tells the operator of the plunge grinder when the wheel must be crush-trued. On the average, crush-truing is needed after grinding six shaving tools.

Russian Developments in Electro-Erosion Machining

Electro-erosion machining is now finding wide application. Profiled parts such as drawing dies can be economically produced from the solid in hardened steel or tungsten carbide by the process. The quality of surface finish obtained, however, even at slow rates of penetration, may not be as smooth as that obtainable with conventional machining methods.

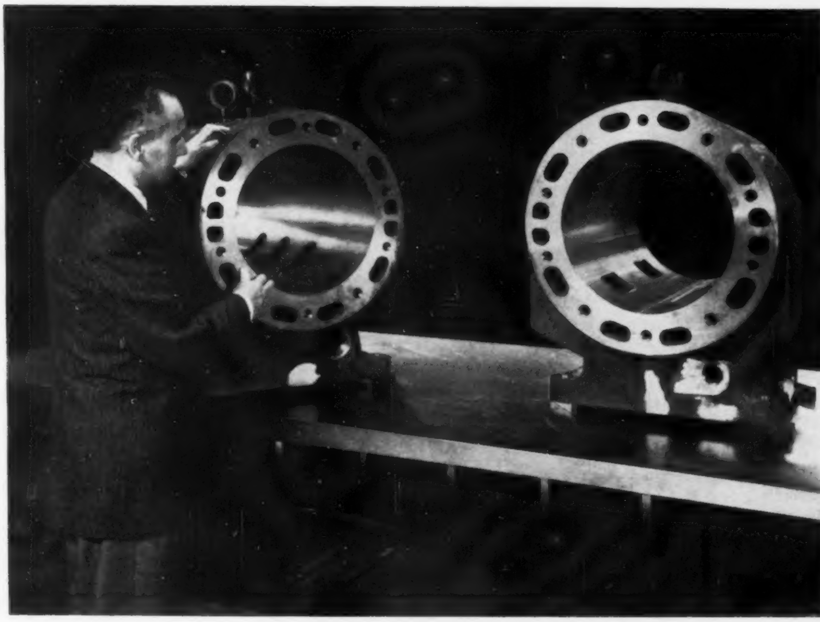
In the case of tungsten carbide, surface micro cracking is also liable to occur, and a film, caused by the anodic dissolution of the cobalt bond, can result. These micro cracks are believed to be caused during the process by the thermoelectric action of impulse discharge upon the titanium and tungsten carbides, and the cobalt bonding material, all of which have different coefficients of thermal expansion.

To produce an improved surface finish, and to prevent the formation of a defective surface layer, special electrodes with an abrasive content are stated to have been developed and used with success in Russia. These electrodes are composed of fine copper or aluminum powder mixed with 25 or 40 per cent by weight, respectively, of powdered silicon carbide having a grain size in the range from 150 to 220.

The electrode mixture is poured into molds of the required shape and subjected to a pressure of 15 to 20 tons per square inch on a hydraulic press. Sintering is then carried out in a furnace at a temperature of 1080 degrees C. for copper electrodes, and 650 degrees C. for aluminum electrodes. The time allowed for the sintering operation is approximately forty minutes.

Sintered electrodes are ready for use after cooling. The wear resistance of sintered copper electrodes can be increased by soaking in a thermosetting plastic solution and then drying them at a temperature in the range of from 75 to 100 degrees C. Since aluminum powder is somewhat difficult to handle, alcohol is usually added to the mixture before the molding operation.

Aluminum-powder electrodes are much cheaper than those made of copper powder and have a better wear resistance. In addition, the electrical conductivity of a sintered aluminum-powder electrode is higher.



Machining of Cylinders for Air Compressors Simplified

INTERRUPTED precision boring of cylinders made of relatively hard and close-grained cast iron is a common machining operation at the Fuller Co. plant, Manheim, Pa. This company, a subsidiary of the General American Transportation Corporation, produces air compressors in a number of sizes, the largest of which has a body 52 inches long and a 14 1/2-inch diameter bore. Intake and discharge ports intersect this bore at several locations, making the specified 0.001-inch accuracy and smooth finishes all the more difficult to obtain.

Machining of these castings (heading illustration) is accomplished on Bullard horizontal boring mills equipped with 4-inch diameter spindles. Setup operations on each machine are facilitated by "Pendant Control." This compact control box can be adjusted in height and swung

Fig. 1. Pendant Control is used by machinist to operate spindle. Simplifying setup of the cylinder, this control can be moved to various positions handy for the operator.

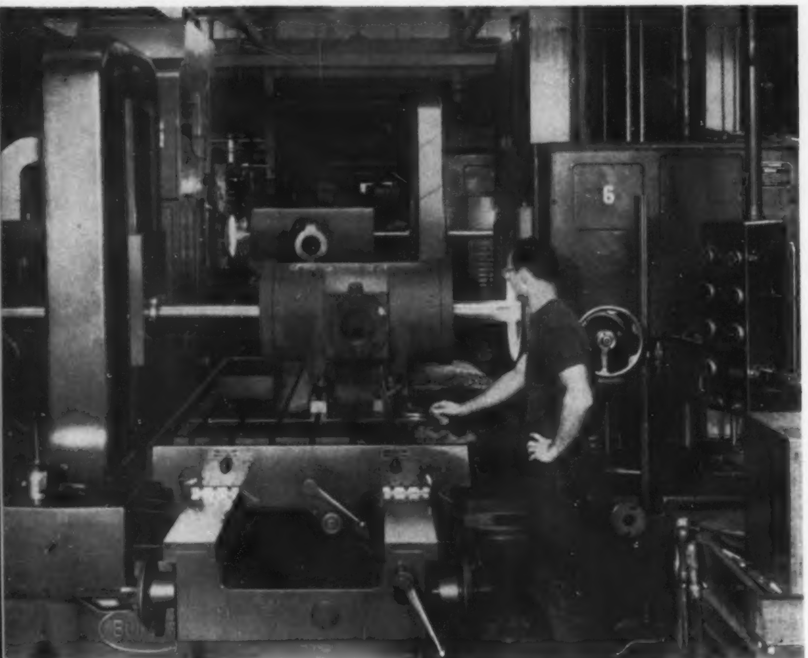


Fig. 2. Cast-iron compressor cylinder being bored on horizontal boring mill. Facing operation is performed with casting in same setup.

at a fixed radius about a vertical axis to a position convenient for the operator on either side of the machine. In Fig. 1 the operator is regulating the spindle rotation by means of a lever on the panel of the Pendant Control.

After the base is milled, the work-piece is mounted on that surface and one end is faced. The cylinder is then ready for boring. With the first roughing cut, about 3/4 inch is removed from the inside diameter at a feed of 0.0156 inch per revolution and a rotational speed of 44 rpm. The semifinishing cut of 0.025 inch is then taken at the same feed and 52 rpm. For finishing, the tool is advanced 0.0078 inch per revolution at 56 rpm and increases the bore of the cylinder by 0.014 inch.

Two eccentric cuts made at the base of the cylinder wall are required to form a precise oval. This design is a feature of Fuller compressors. For these cuts, the table is raised 0.010 inch and then 0.008 inch, keeping the spindle on the same vertical center line. The feeds used are 0.0156 and 0.0078 inch per revolution, and the speeds, 78 rpm in each case. Edges formed at the intersection of the eccentric and primary bores are removed in the sixth and final boring operation. The compressor body is completed by facing the opposite end and a side pad.

Although the cylinders have a Brinell hardness ranging from 170 to 210 and the cuts are interrupted, tolerances are easily held and the necessary smooth finishes easily obtained. With present tooling and machines, production time has been reduced to nine hours from the thirteen required for the previous setup. In addition, the Bullard heavy-duty, horizontal boring mills, being versatile, are employed for machining many other products of the company. A smaller-size compressor cylinder is seen being bored in the foreground of Fig. 2.

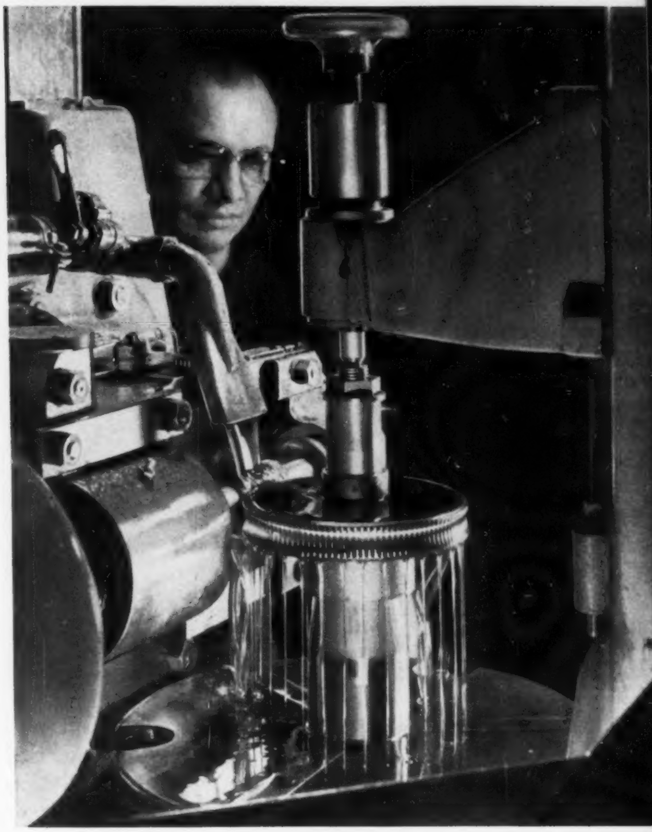
* * *

Continuous Brazing Produces Stainless-Steel Honeycomb Panels

Two processes have been developed by Temco Aircraft Corporation, Dallas, Tex., to provide stainless-steel honeycomb panels economically for aircraft and missile construction. One of them, called "Temcombing," is a continuous process of fabricating the stainless-steel sandwich panels. The other is a simplified, two-stage process for the brazing of these structures.

In the continuous process, brazing is performed at a rate of from 3 to 20 inches per minute, depending on the panel thickness. Panels up to 4 feet in width and 10 feet or greater in length can be produced by this method. Fully automated equipment is used which simultaneously brazes and heat-treats the assembly. Airframe contours made by the process may have either a single curve or a moderate double curve. Stainless-steel structures are better suited to the high temperatures encountered in missile operation.

Cutting Oils Tailored to the Job by Using Concentrates



GEORGE VOSMER
Manager, Cimcool Division
Cincinnati Milling Machine Co.
Cincinnati, Ohio

BLENDING cutting-oil concentrates with mineral oils in the user's plant offers a number of advantages. Most important of all, such practice provides a low-cost way of obtaining dilutions tailored to suit each machining operation.

The cutting oils used in metalworking operations (not including water-based fluids) are composed of two ingredients: (1) the active lubricity agents and (2) the base, or carrier, mineral oil. The active ingredients are usually fats or other oils which have been treated with sulphur and chlorine, or both. Experience has shown that sulphur and chlorine provide friction reduction between the tool face and the chip, which leads to cooler cutting and lengthened tool life. The way in which these chemicals are held in the active agent has a bearing on their efficiency in producing long tool life.

The mineral oil comprises the largest percentage of the mixture. The base oil may be either paraffinic or naphthenic and will vary in viscosity from about 100 SSU (Saybolt Seconds Universal) to over 800 SSU.

The great number of cutting oils available on the market today is due to the large number of possible combinations of the two basic ingredients. Different active agents can be diluted in a variety of base oils (the significant variation in the base being viscosity). Mixtures carry different trade names and numbers but many of them have merely different percentages of an active concentrate diluted in mineral oil.

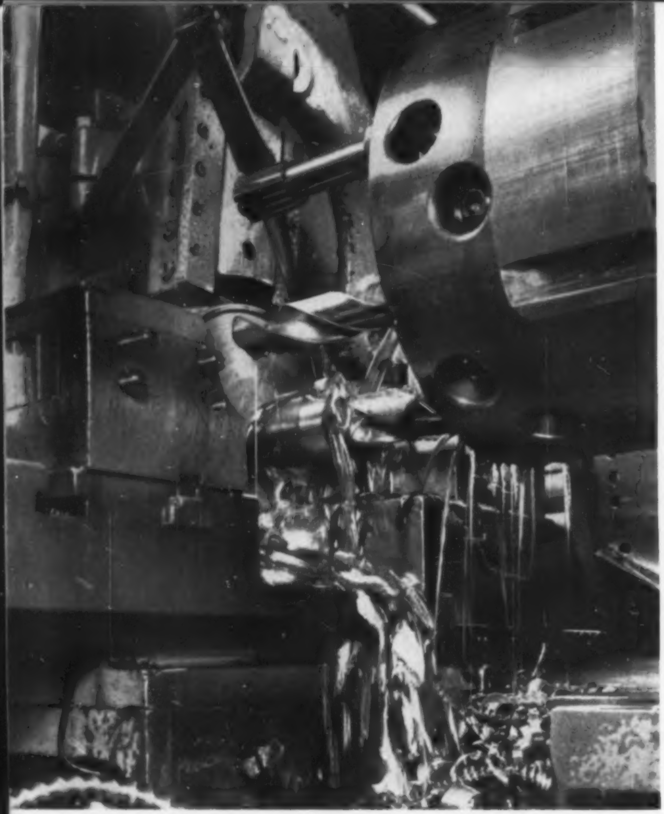
There are also on the market a relatively limited number of oil additives or concentrates which can be purchased to blend with mineral oils in the shop. The additive can be blended in a percentage suitable for each particular job. The resultant mix may be the same as a cutting oil that can be bought already blended.

Blending of oils can be done easily in the user's plant. Mixing the oil and concentrate can be done on any level of usage, regardless of whether cutting oil is used in tank car quantities or in amounts as small as a 55-gallon drum. Tank car amounts can be mixed directly in the tank by adding the concentrate and circulating by pump for several hours. Similarly, 55-gallon amounts can be blended in the drum by adding the concentrate and stirring with a hand paddle.

Concentrates provide an economical means of obtaining wide flexibility in the use of oil coolants. Cimcut AA concentrate, for example, can be diluted in a standard base oil, in percentages suited to each particular job. Thus, a single concentrate and a single base oil can fill the needs of a department with varied cutting-oil requirements.

For instance, a 4 per cent dilution may be satisfactory for the majority of machines; an 8 per cent dilution may be required for a job involving the drilling and reaming of cast steel; and a 1 per cent dilution may be adequate for turning and cutting off parts of SAE 1112 steel.

It is also possible with oil concentrates to strengthen a cutting oil if the job changes. If a machine turning SAE 1112 steel and using a 1 per



cent dilution is changed over to turn, drill, and bore a part of SAE 1010 steel, the cutting fluid can be "beefed up" to a 3 or 4 per cent dilution by merely adding more concentrate to the coolant sump.

On a screw machine or a turret lathe it is possible to apply the concentrate directly to the job with a squirt can if difficulty is experienced on one of a series of operations. For example, if a tap is producing poorly finished threads in a material difficult to machine and if the concentration of the cutting oil is satisfactory for the other cuts, the concentrate can be manually squirted on the tap during its cutting time. Cutting oils removed from machines can be filtered and used over again, after adding concentrate to restore cutting properties when necessary.

By tailoring the cutting oil to the job, a heavier-than-necessary cutting oil is not likely to be used on an easy job. Also, the shop does not have to buy and store a different cutting oil for each degree of machining difficulty experienced. On a multiple-operation machine a cutting oil can be mixed to handle most of the operations, and the concentrate applied directly to a tough cut, as already mentioned.

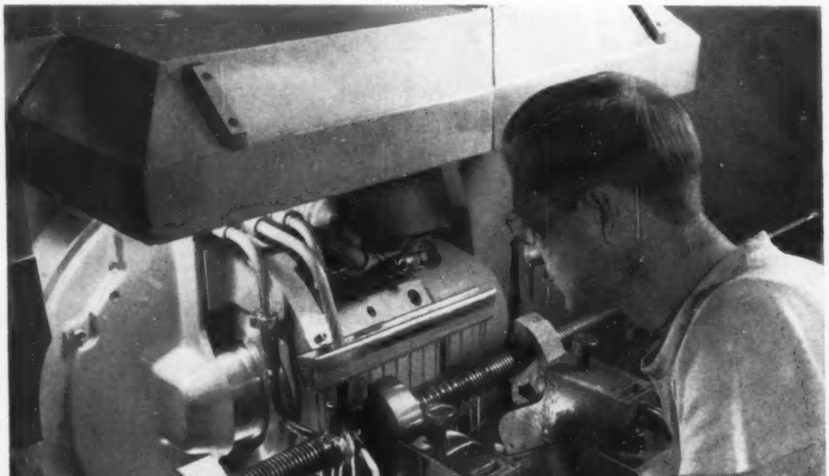
Few purchase orders, a small amount of storage space, and a small inventory are other advantages of using cutting oil concentrates. Two oil concentrates, one for ferrous and one for nonferrous metals, plus a quantity of mineral oil, will generally meet requirements.

Several machining operations in which blended cutting oils are being used are here shown. The heading illustration, for example, shows an operation in which a worm-wheel approximately 6 1/2 inches in diameter is being hobbed. The material is Ampco bronze and the cutting compound is made up of 4 per cent Cimcut NC blended in a mineral oil having a viscosity of 200 SSU.

In Fig. 1 is shown a drilling, reaming, and form-turning operation on a single-spindle automatic. The cutting oil is obtained by using 4 per cent Cimcut AA with a mineral oil having a viscosity of 220 SSU. Fig 2 shows an operation in which a lead-screw for a milling machine is being finish-ground. The cutting oil has been made up by blending 2 per cent Cimcut AA with a mineral oil having a viscosity of 250 SSU.

Fig. 1. (Above) Operation on a single-spindle automatic in which the cutting oil consists of 4 per cent Cimcut AA blended with a mineral oil having a viscosity of 220 SSU.

Fig. 2. (Right) Precise grinding operation on a lead-screw for a milling machine in which the cutting oil is comprised of 2 per cent Cimcut AA blended with a mineral oil having a viscosity of 250 SSU.



PNEUMATIC SAFETY CONTROL FOR PRESS BRAKES

REDUCTION in the frequency and severity of industrial accidents is of major importance to everyone. Power presses, which present a major source of industrial accident hazards because of their function, have been the subject of intensive effort to improve their safety conditions. A significant step in this endeavor is the recently published Canadian Standards Association Code (Z142-1957) for the Guarding of Punch Presses at Point of Operation.

This Code was drawn up with the help of builders and users of press equipment. One of its principal aims is to avoid some of the accidents that occur because ways are found to circumvent the controls. Safeguarding requirements are established dependent on the method of feeding the press, the press operating speed, and the type of clutch used. New requirements for two-hand trip control are specified.

Several all-air, press control circuits have been developed to meet the Code requirements. One such air circuit is used to control a Bath press brake, seen in the heading illustration, at the Distribution Apparatus Plant, Canadian Westinghouse Co., Ltd., London, Ontario, Canada. This press is used to form a wide variety of sheet metal parts for electrical distribution apparatus. The pneumatic safety circuit is shown mounted on the side of the press brake in Fig. 1, and schematically in Figs. 2 and 3.

A feature of this air circuit is that operation of the press brake can be set for foot actuation only, or for actuation by foot and two palm buttons. Foot-treadle actuation would be safe to use if the operator were required to hold the work beyond arm's reach of the dies. For smaller workpieces, the other alternative would be used—making it necessary for the operator to depress both palm buttons simultaneously and then depress the foot-treadle to actuate the clutch.

To use the two palm-button and foot actuation method of safety control, a Ross "non-tie-down" valve—indicated at *A* in Fig. 2—is provided. As can be seen in Fig. 4, the right- and left-hand halves of this valve are identical—each half having its own inlet, and the single outlet (or receiver connection) being in the middle. A three-way, normally closed, palm-button pilot valve (*B* in Fig. 2) is used to supply each inlet on the "non-tie-down" control valve. If the flow of air through the "non-tie-down" valve from each pilot valve is not balanced, one of the control valve pistons will shift and vent any outlet pressure to exhaust. This insures that the press-brake operator use both hands simultaneously to initiate a cycle. If the operator engages only one of the hand valves, the control valve will automatically prevent downstream pressure build-up until that hand valve is released and both hand valves are tripped in unison. Release of either one of the hand valves will cause the control valve to exhaust any down-stream pressure.

In setting up for two palm-button and foot-treadle operations, an authorized person locks "out" valve *C* and locks "in" valve *D*. This condition prevents operation of the press brake if the foot-treadle is tripped independently. To operate the press brake, both palm-button valves *B* are depressed simultaneously, as required by the "non-tie-down" valve *A*. This introduces pressure through control valve *A*, shuttle valve *E*, normally open valve *F*, and shuttle valve *G*, to the piston-rod end of cylinder *H* (Fig. 3). As the rod retracts, the clutch actuating rod *J* (normally in a floating or slack condition) is drawn taut.

While still maintaining contact on the palm buttons, the operator depresses the foot-treadle.

This fully retracts the rod, thus releasing the brake, engaging the clutch, and also advancing the ram. Should the operator release either palm button before the ram reaches its automatic-stop position, the ram will stop immediately, since the cylinder will be exhausted. If he should release the foot-treadle before the ram reaches that position, the ram will stop because of the mechanical tie with the clutch.

When the treadle is depressed, pilot valve *K* (Fig. 2) is energized, supplying pilot pressure to the head of the normally open valve *L* which closes. As the press-brake ram descends, and cam No. 2 contacts valve *M*, pilot pressure is introduced to the normally open valve *F*, which closes to pressure from valve *E* and opens to exhaust. Thus, cylinder pressure is dumped to stop the ram. Pilot pressure from valve *M* is also introduced to the inlet port of valve *L* because valve *D* is in a locked-in position.

To "inch" the press-brake ram, the operator must fully release the foot-treadle, and then depress it again. In so doing, pilot pressure to valve *L* is dumped through valve *K*. Valve *L* opens and pilot pressure from valve *M* energizes valve *N*. Pressure through this valve shifts shuttle valve *G*, allowing pressure to again recharge cylinder *H*. The operator can then depress the foot-treadle slowly to inch the ram, or trip the treadle rapidly for fast advance of the ram.

As the ram rises, cam No. 3 energizes valve *O* and opens the downstream side of the single-stroke valve *P* to exhaust. This is only necessary when the foot actuation is used alone. Since valve *K* is keeping valve *L* energized and closed to pressure, pilot air between valve *N* and pilot valve *Q* is retained until cam No. 1 trips valve *Q* at the top of the stroke. Pilot air to valve *N* having been exhausted, the valve is reversed and pressure is exhausted from the cylinder to stop the ram at the top of its stroke.

To operate the press brake by foot-treadle only, valves *C* and *D* are locked "in." Then, as the treadle is depressed, valve *K* is energized to supply pilot pressure through the locked "in" valve *C*, the single-stroke valve *P*, shuttle valve *E*, normally open valve *F*, and shuttle valve *G*, to the piston-rod end of cylinder *H*. This draws the clutch-actuating rod *J* taut. As the single-stroke valve *P* closes and the press-brake ram descends, cam No. 2 actuates valve *M*. This energizes valve *F*, which closes to pressure and exhausts the cylinder, thus stopping the ram. Pilot air is directed to the inlet port of valve *L*, which is held closed by valve *K*.

To initiate an inching stroke, the operator must release the foot-treadle. This deenergizes valve *K*, which exhausts pilot air to the head of valve *L*, returning it to its normally open position. Pressure now is admitted to the pilot of valve *N* from valve *M*, opening valve *N*. Supply pressure also shifts shuttle valve *G* to recharge the cylinder.

When the foot-treadle is again depressed, the press-brake ram passes through its inching stroke. On the upward stroke of the ram, cam No. 3 energizes valve *O*, dumping the pilot pressure downstream of the single stroke valve *P*, and exhausting the lines up to the inlet port of energized valve *F*. At the top of the ram stroke, cam No. 1 trips valve *Q*, and pilot pressure to valve *N* is exhausted—causing it to close to pressure and open to exhaust. This dumps the supply pressure to the cylinder, which in turn stops the ram of the press brakes.

Cam No. 2 is adjustable, and is pre-set for the specific job being run so that when valve *M* is energized on the down stroke of the ram, the ram will stop. This "pinch-point" distance is usually 1/16 inch above the work when operat-

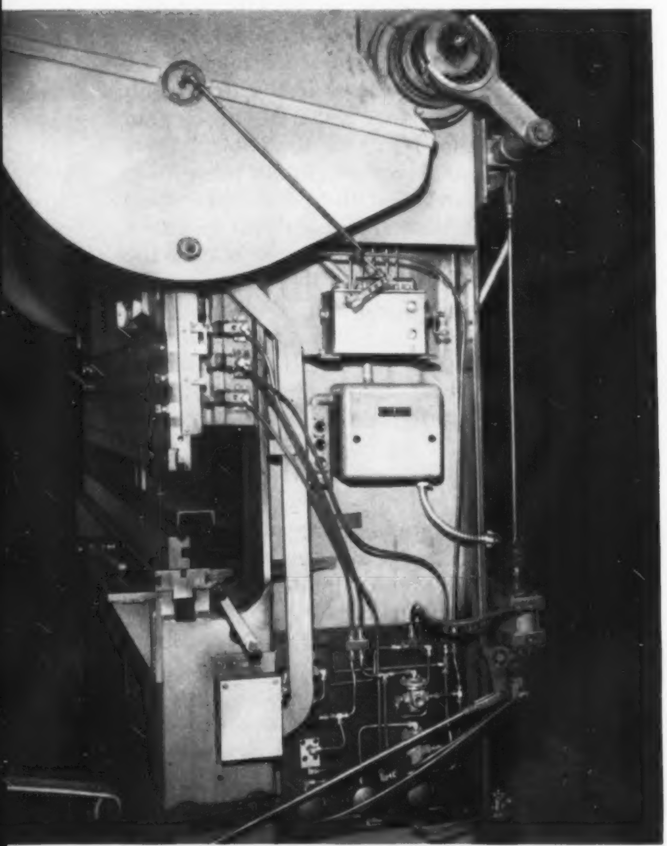


Fig. 1. End view of the press brake seen in the heading illustration shows components of the all-air control circuit which improves operator safety.

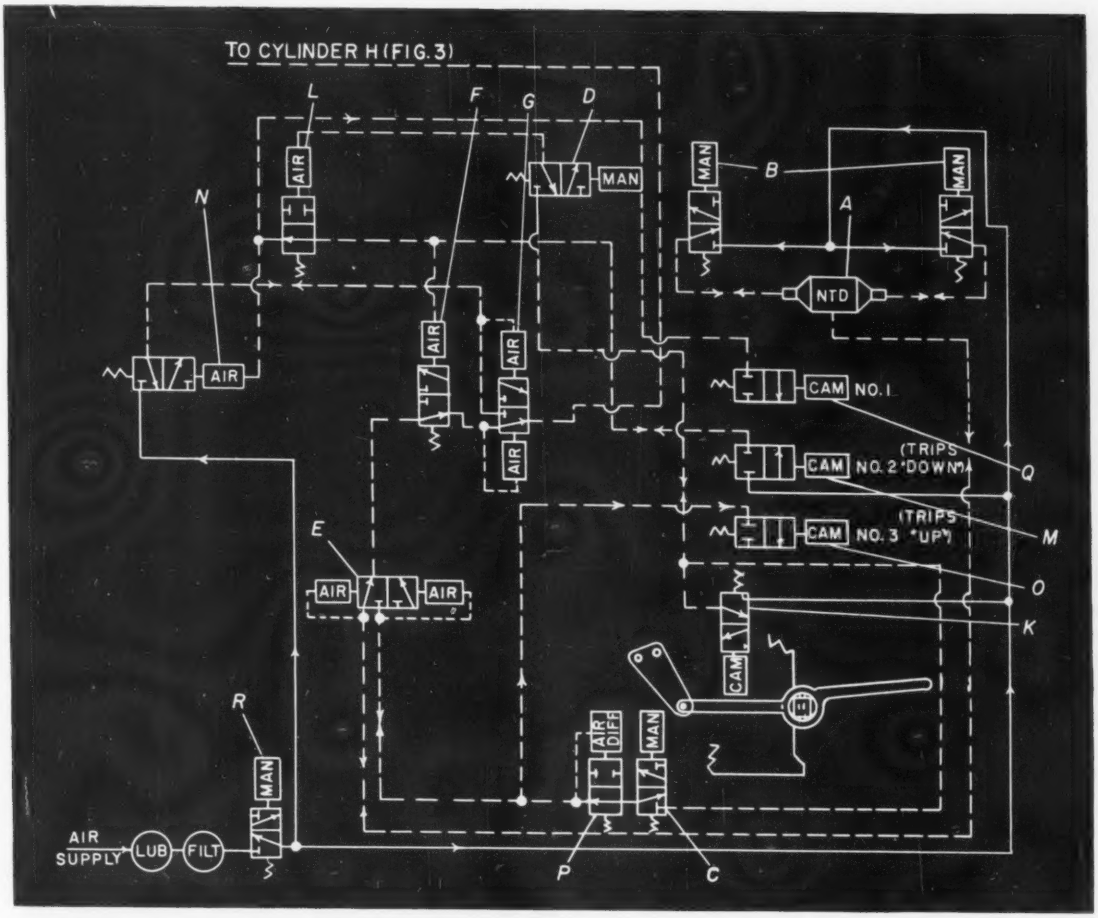


Fig. 2. (Above) Schematic drawing of pneumatic safety circuit that can be employed to actuate press brake by foot-treadle only, or by treadle and two palm buttons (which must be depressed simultaneously).

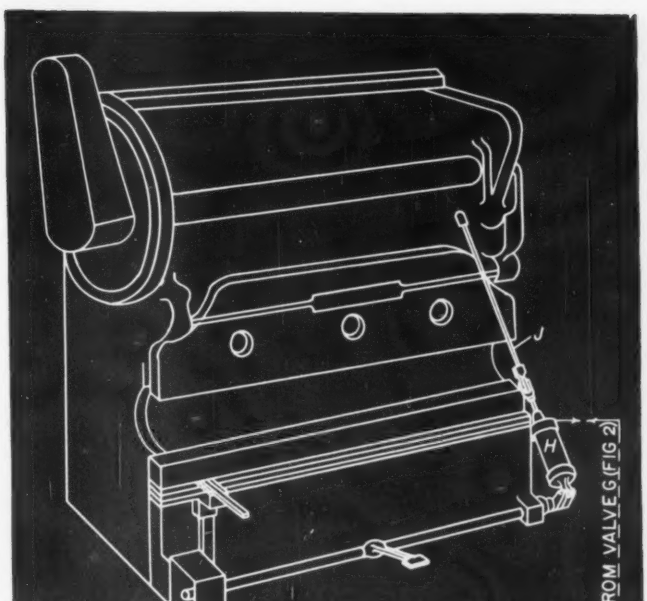


Fig. 3. (Right) Rod (J), actuated by cylinder (H), is used to advance or stop the press-brake ram by releasing or operating the brake, and engaging or disengaging the clutch.

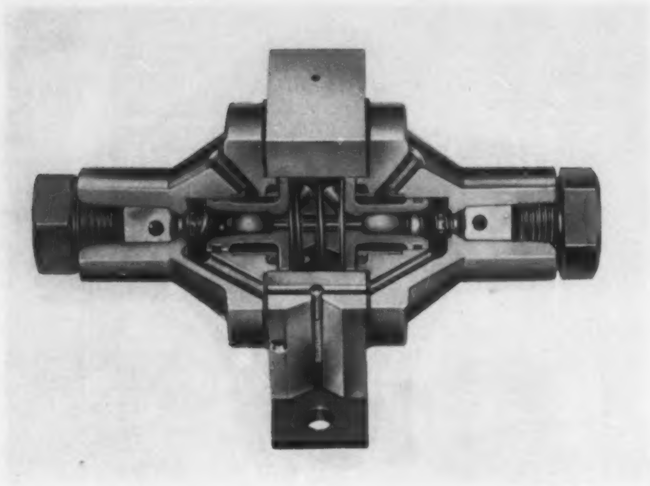


Fig. 4. The "non-tie-down" valve, such as the one indicated at (A) in Fig. 2, has an inlet at each end. For two-hand operation it is used in conjunction with a pair of three-way, normally closed, spring-returned hand valves, usually of palm-button design.

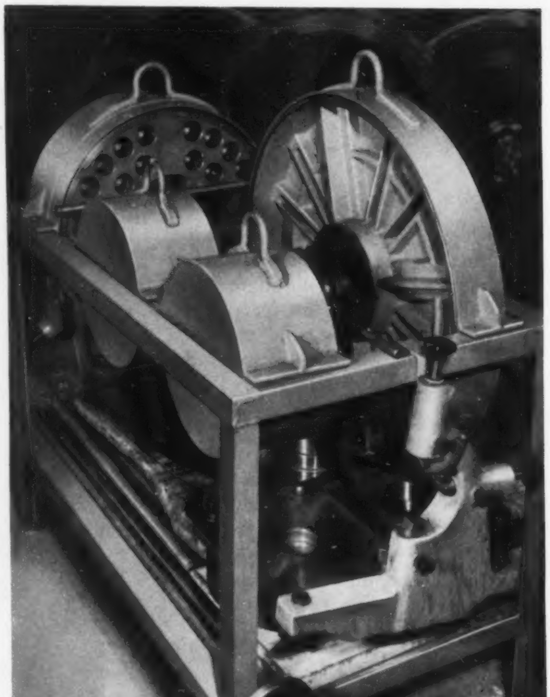
ing with the two palm buttons, or slightly more than the thickness of the operator's fingers when operating by foot-treadle alone. This arrangement for rapid advance of the press-brake ram and automatic, adjustable stop eliminates the need for jogging. The Canadian Standards Association Code requires that the pressure in the valve system be bled off while changing dies or performing maintenance work on the press brake. This is accomplished by locking out valve *R*.

When the press brake is to be used for an uninterrupted, 360-degree cycle, valve *D* is locked "out," and the palm-button valves must be held depressed for the first 180 degrees of the cycle. The "non-tie-down" valve *A* is mandatory under the Canadian Standards Association Code, which stipulates that simultaneous tripping of both palm buttons is required.

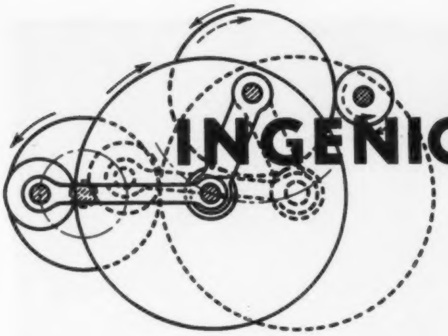
Protective Covers for Lathe Chucks and Faceplates

Arthur Soderstrom, Stockholm, Sweden

Lathe chucks and faceplates, when not in use, can be kept free from dust and chips by means of the sheet-metal covers here illustrated. In addition to protecting the lathe accessory, each cover has a lifting lug welded to the periphery for easy handling with an overhead hoist. A leather lining is provided on the inner surface of the covers to prevent scratching of finished metal surfaces. For storage in a rack of the type shown, a supporting lug may be welded to each side of the cover a little above the horizontal center of the chuck. The particular rack seen in the accompanying illustration holds four large chucks and faceplates. These accessories should be stored in the rack with the covered face outward. Other smaller lathe equipment can be kept on the lower shelf.



Covered lathe chucks and faceplates stored in a convenient rack. Covers are also used to convey the accessory to the lathe spindle.



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

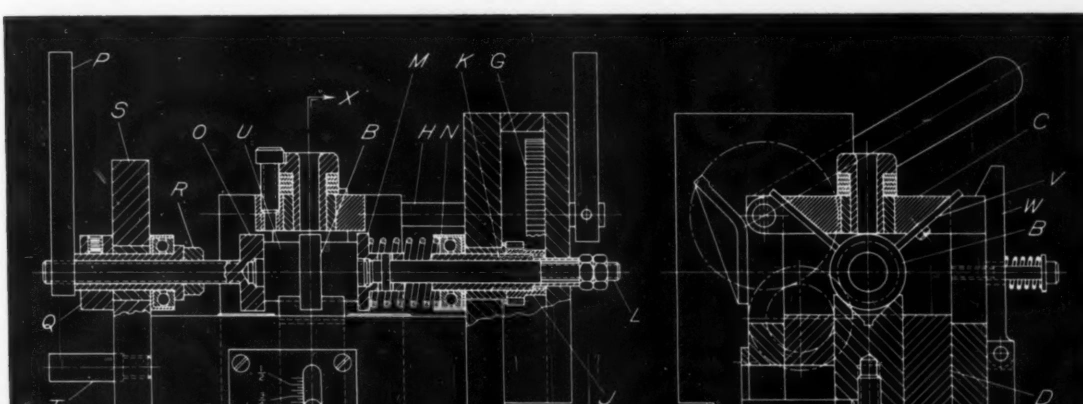
Clamping and Indexing Mechanism for Drill Jigs

George G. Herzl, Phoenix, Ariz.

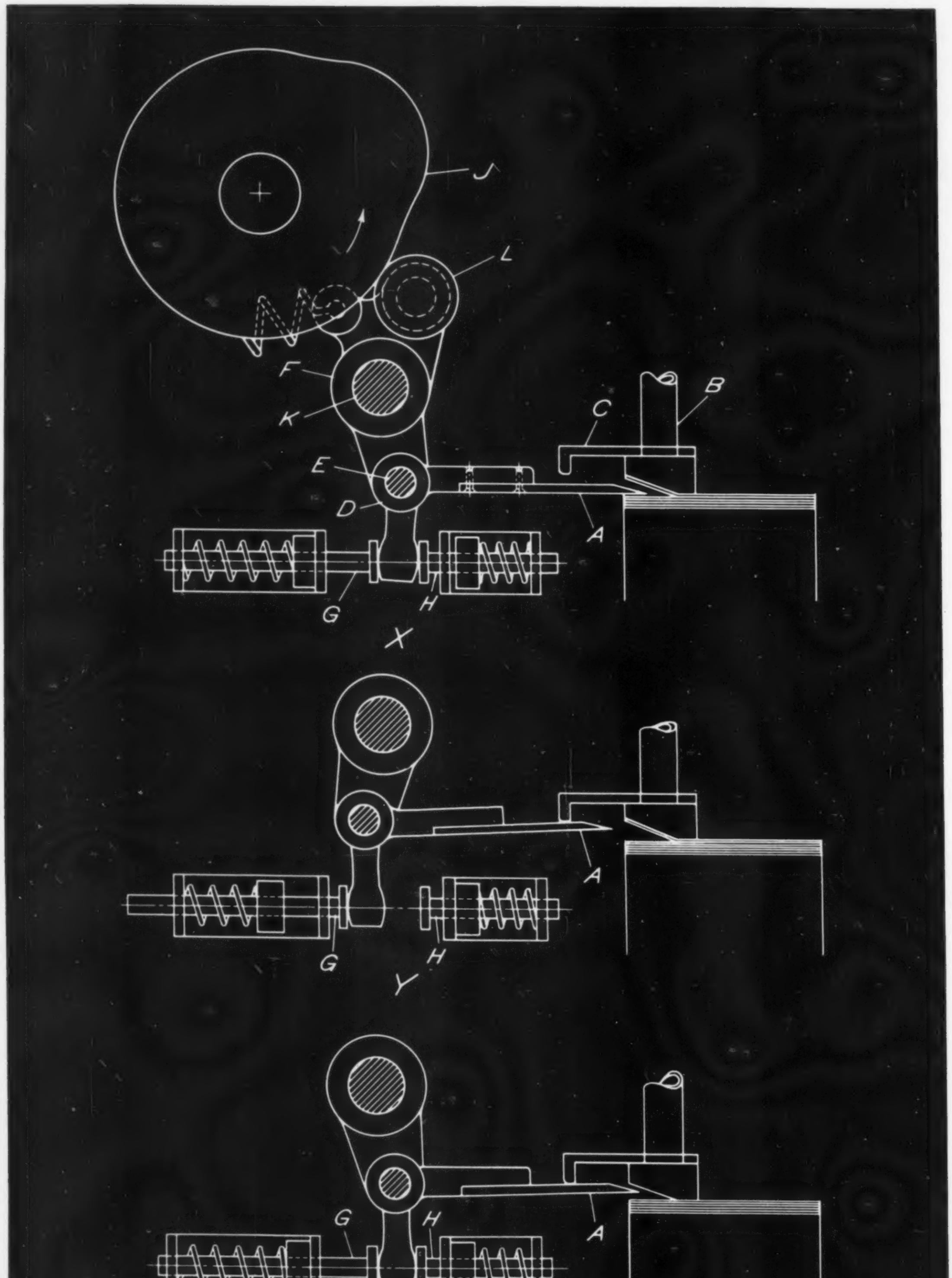
A multiple-purpose drill jig that incorporates an arrangement to automatically clamp a work-piece simply by lowering a hinged jig plate into position is here illustrated. In addition, components can be rotated and indexed for drilling a number of radial holes without being unclamped between operations. Although it was originally designed to accommodate collars and pinions in a variety of widths and diameters, the jig can be adapted to handle many other types of cylindrical parts.

Basically, the jig consists of an adjustable V-block *A* to support the work-piece *B*, a hinged jig plate *C* with a replaceable bushing to locate and guide the drill and a means of clamping and rotating the part. The V-block is raised or lowered in guide block *D* by turning the knob end of adjusting screw *E*. A pointer on scale *F* indicates the diameter of collar that can be drilled at each vertical position of the V-block.

Gear *G* transmits the rotary motion of shaft *H* through a gear train to gear nut *J* which moves externally threaded sleeve *K* in an axial direction. The gear nut is held in its axial position by a bushing and the outer-bearing support plate. Shaft *L* is a sliding fit in the bore of the threaded sleeve. A pin is pressed into shaft *L* and is fitted into slots in clamp *M*. Shaft *L* and clamp *M* must



Drill jig with mechanism for clamping and indexing a variety of cylindrical parts. Clamping action is concurrent with lowering of hinged jig plate.



Hold-down finger (A) is synchronized with suction cup (B) through cam (J) and bellcranks (D) and (F).

rotate together but can move axially about 1/8 inch in relation to each other. A coil spring pushes clamp *M* toward the work-piece and is allowed by thrust bearing *N* to rotate freely with the clamp and the shaft. Forward motion of shaft *L* is restrained either by the work-piece through clamp *M* and its retaining pin or by threaded sleeve *K* through lock-nuts. The latter is the case when clamp *M* is not in contact with the work-piece.

Clamp *O*, lever *P*, and an internally threaded sleeve with its retaining collar *Q* and lock-nut *R* may be rotated as a unit in a fixed axial position. A thrust bearing allows free movement of the parts under any heavy clamping force applied to the work-piece by clamp *M*. Index holes are provided in bearing support plate S for insertion of threaded stop *T*. This stop is used to accurately position lever *P* and, therefore, the work-piece for the drilling of radial holes.

Axial position of clamp *O* can be adjusted to suit work of various widths by advancing or retracting this member within the internally threaded sleeve which is held in place by lock-nut *R*. In similar fashion the lock-nuts on the end of shaft *L* provide a means of adjusting the axial position of clamp *M*.

This jig is simple to use. A work-piece is placed on the V-block which is then set to the proper height by means of the adjusting screw. The rotary motion of lowering the jig plate into position is converted to the horizontal translation of threaded sleeve *K*. Clamp *M* (and its retaining shaft) are forced by the compressed spring to duplicate this movement and clamp the work-piece properly. The lock-nuts on shaft *L* should extension pieces *U* are screwed into the faces of the clamps to increase the range of the jig. Clamp *O* is pre-set axially to locate the work-piece properly. The lock-nuts on shaft *L* should be adjusted so that the pin is not in contact with either end of the slot in clamp *M* when the work-piece is securely gripped. This will prevent friction between the threads in parts *J* and *K* when the work is rotated.

After drilling the first hole in the work-piece, lever *P* is indexed to the stop for the second hole. Additional radial holes can be produced by moving the threaded stop to the next indexing position and repeating this operation. Clamping pressure is maintained on the work-piece since thrust bearing *N* allows the spring to rotate freely with clamp *M*. Adjustable work stops *V* prevent parts from being pulled up when the drill is retracted, and spring-actuated latch *W* holds the jig plate down in position for drilling.

Finger Holds Down Paper Stack on Printing Press

WILLIAM M. FOSTER, New Hyde Park, N. Y.

On printing presses, some type of suction device generally feeds the paper by lifting the leading edge of the top sheet in the stack and drawing the sheet forward into grippers. To avoid the tendency of the top sheet to pull the next sheet with it—as sometimes happens because of static electricity in the paper—a mechanical hold-down finger can be added to the press. Through a cam and double bellcrank construction, the finger operates in time with the suction device, and separates the top sheet.

The accompanying illustration shows three positions of the mechanism. In view X, the finger *A* holds down the stack of paper after the leading edge of the top sheet has been lifted by suction cup *B*. (Actually, there are two or more suction cups.) The bottom of the cup is cut at an angle, as shown, so as to raise the sheet edge sharply. Guide *C*, fastened to the cup, moves up and down with it.

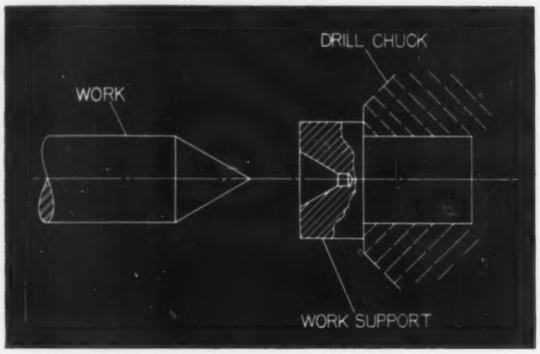
The finger is attached to one arm of small bellcrank *D*, which pivots on shaft *E* in the lower arm of large bellcrank *F*. Two spring-loaded plungers *G* and *H* control the lower arm of the small bellcrank. Cam *J*, revolving continuously in time with the movement of the suction cup, causes the large bellcrank in turn to pivot on shaft *K* under the direction of follower *L*.

When the suction cup comes down on the stack, the finger is pulled back, and under the pressure of plunger *G*, it is forced upward against the guide, as in view Y. At this point, the lobe of the cam bears on the follower, and the suction cup lifts the edge of the top sheet.

Then, as the lobe leaves the follower, plunger *G* loses control of the lower arm of the small bellcrank and plunger *H* takes over, as in view Z. The guide, meanwhile, forces the finger down, directing it into the lip formed by the raised edge of the top sheet. When the finger is fully in place, as in view X, the suction cup assembly raises the sheet into the grippers which feed it into the press.

Cycling is continuous, with the cam revolving once for each sheet fed. A feature of the mechanism is that the finger is located by the position of the feed cup, so is not affected by variations in the height of the paper stack.

SHOP KINKS



The work-support has a conical depression corresponding to the taper of the rod end.

Support for Cone-Shaped Rod End

F. L. Rush, Woodbourne, N. Y.

Long slender rods with cone-shaped ends can be held between centers on a lathe for secondary operations by use of the device illustrated. It consists of a shouldered plug of bronze or brass, with a center hole of the same included angle as that on the end of the work. This support is gripped in a drill chuck which, in turn, is held in the lathe tailstock. Or, the support can have an integral shank fitting the tailstock directly.

Circle Guide for Cutting Torch

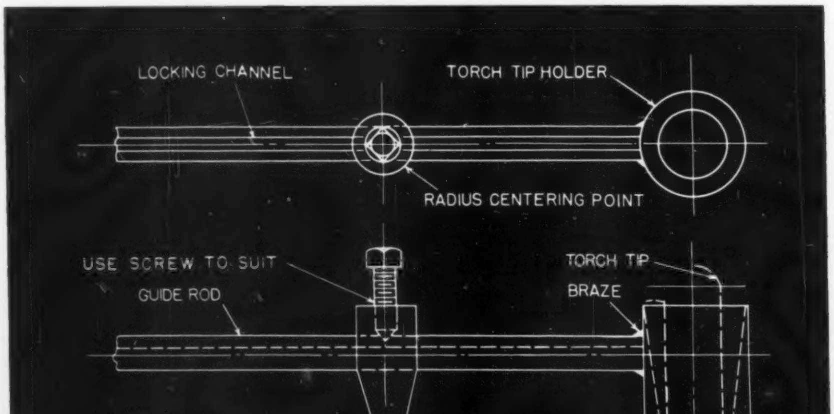
Robert Hill

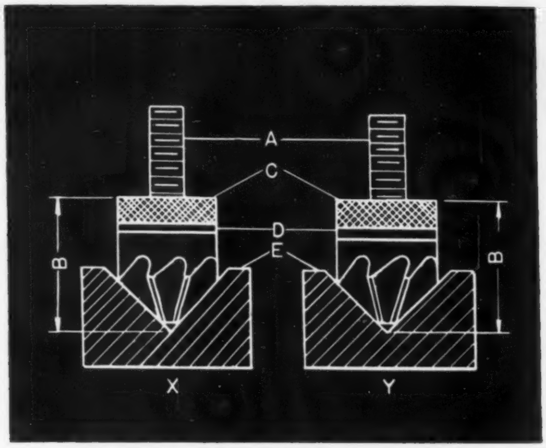
In cutting circles and arcs with an oxy-acetylene torch, a guide such as here shown will be found useful in moving the torch around the work outline. The work-piece is first scribed and the center of the circle or arc is punched. The centering point of the guide is next adjusted so that the distance from the conical point of the guide to the center of the torch-tip holder is equal to the radius of the circle or arc to be cut.

In the cutting operation, the conical point of the guide is placed in the center punch, and the torch tip is inserted in its holder on the opposite end of the guide rod. This rod has a handle at one end by means of which the torch can be easily rotated between 360 degrees if a full circle is to be cut on the work.

The guide rod is provided with a channel groove by means of which the centering point can be locked in place so that the point will not turn on the guide rod during the cutting operation. The torch-tip holder can be attached to the guide rod by brazing or by drilling and reaming a hole in the torch holder and inserting one end of the guide rod into the hole. The torch holder is shown with an internal taper, but it can be made with a straight hole.

Circle guide which facilitates the cutting of circles and arcs on steel plates by the application of an oxy-acetylene torch.





Countersink that is designed to eliminate resetting the depth of cut whenever a replacement is required. Dimension (B) is standardized on all stand-by countersinks.

Countersink Designed for Easy Replacement

BUCKLEY SULLIVAN, Shaker Heights, Ohio

In some shops, the setting of replacement countersinks in multiple-spindle drilling machines is a cut-and-try operation. One method of reducing the resulting machine down time is with the use of countersinks that can be adjusted to maintain a fixed axial position for the cutting edges after each sharpening.

The special type of countersink *A*, shown at X in the accompanying illustration, is used in one shop to solve this problem. A fixed, standardized distance *B* is maintained between the conical face of each cutter and lock-nut *C* by means of a replaceable washer-shim *D* and a simple indicator-equipped fixture *E*. When a countersink is ground, it is placed in the conical recess in the fixture and the change in the vertical height of lock-nut *C* is checked by the indicator (not shown). A washer of the proper thickness is then added under the lock-nut to return it to its original position in relation to the face of the cutter. The resharpened countersink, shown at Y, can then be replaced in the machine and used without any further adjustment.

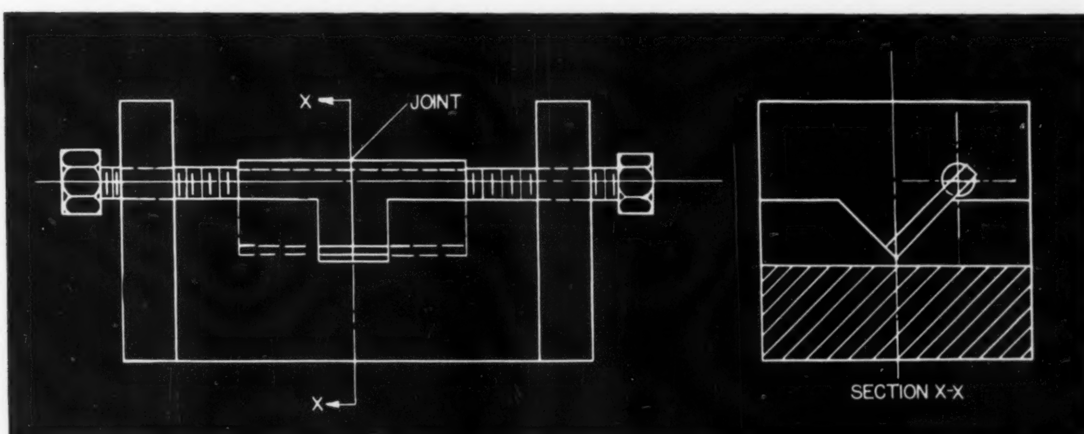
Brazing Gives New Life to Carbide Insert Stubs

RICHARD MINSER, Cleveland, Ohio

Long, carbide prism inserts used in clamp style tool-holders are generally good for only about one-half their length; some 5/8 inch is discarded, being too short to grip in the holder. A good way to avoid this waste is to take two such shortened inserts and braze them together, end to end in the illustrated jig.

First, the mating ends are ground square and cleaned. Then, the two stubs are set up in the jig with a 0.005-inch thick piece of brazing stock between the butted ends. The jig is a small V-block with two end pieces, each threaded for a clamp screw. The center of the block is relieved in the brazing area.

For round, square, or rectangular inserts, the block should have an included angle of 90 degrees; and for triangular inserts, an included angle of 60 degrees. After brazing, the joint is cleaned by grinding it lightly.



When the two stubs are brazed together in this jig, an insert of usable length is obtained.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Multiple Thread-Cutting Attachment for Lathes

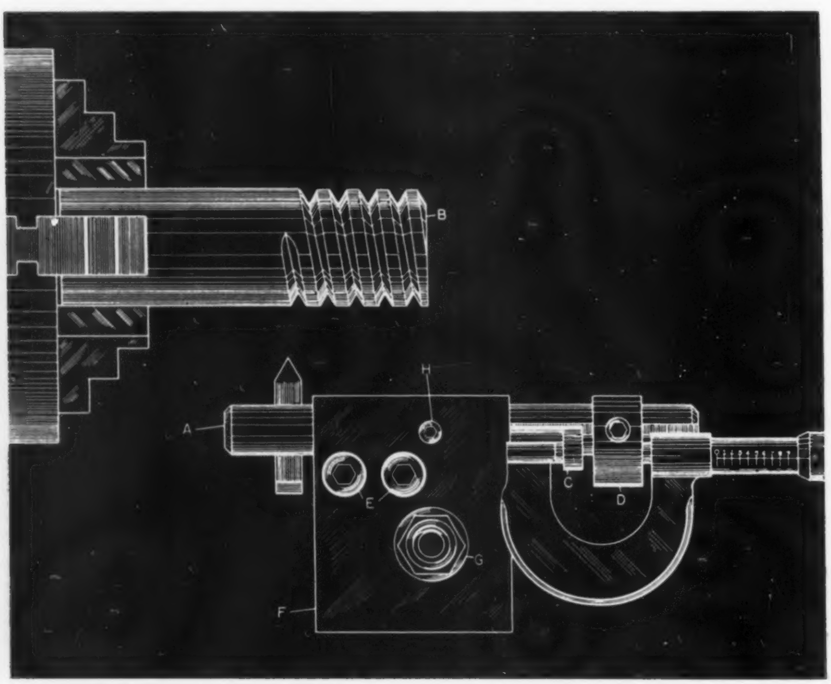
JOSE C. SOBKOWIAK, Jackson, Mich.

In cutting threads having more than one lead several different methods are applicable for correctly locating the second, third, or fourth thread on the work. In many cases the work is rotated while the spindle and lead-screw remain fixed. Sometimes the work and spindle together are revolved the required 1/2 or 1/4 turn, while the lead-screw remains fixed. The latter method is used for internal threads.

With the attachment here shown nothing is moved or changed except tool-bar *A* in cutting internal or external multiple threads. The movement of the tool-bar is accurately measured by means of a micrometer to position the cutter for each consecutive thread lead. In the illustration, one thread has been completed on work *B* with the lathe set up for cutting three threads per inch at a pitch of 0.3333 inch. A second thread will be cut between the lands of the present thread to produce a screw with six threads per inch having a pitch of 0.1667 inch.

When the first thread has been finished, a reading is taken on the feed-screw dial of the compound rest, and a micrometer reading is taken over parts *C* and *D*. Part *C* is a collar integral with a small-diameter shaft which is fixed in block *F*, while part *D* is a collar which is adjustable along the tool-bar.

Two socket-head screws *E* are then loosened to permit the tool-bar to be moved 0.1667 inch either to the right or left to correspond to the difference in pitch between the two thread leads



Attachment designed to facilitate the cutting of multiple threads on a lathe.

to be produced. This movement is checked with the micrometer. The screws are then tightened and the second thread is cut. The amount of movement that is imparted to the tool-bar for any job is determined by dividing 1.0000 inch by the number of threads per inch. For example, in cutting a four-lead thread having 16 threads per inch, the amount of tool-bar movement in positioning for starting the second, third, or fourth threads would be determined by dividing 1.0000 by 16, or 0.0625 inch.

Block *F* is fastened to the compound rest by means of a stud and nut, indicated at *G*, with the tool-bar being mounted parallel to the axis of the lathe. The block is bored to a sliding fit to receive the tool-bar. A slot is milled in block *F* to permit clamping the boring-bar by tightening screws *E*. Set-screw *H* engages a keyway in the tool-bar to prevent the latter from turning during an operation.

For cutting internal threads in a part, the tool bit would be placed in the bar with the cutting edge on the side opposite to that shown in the illustration.

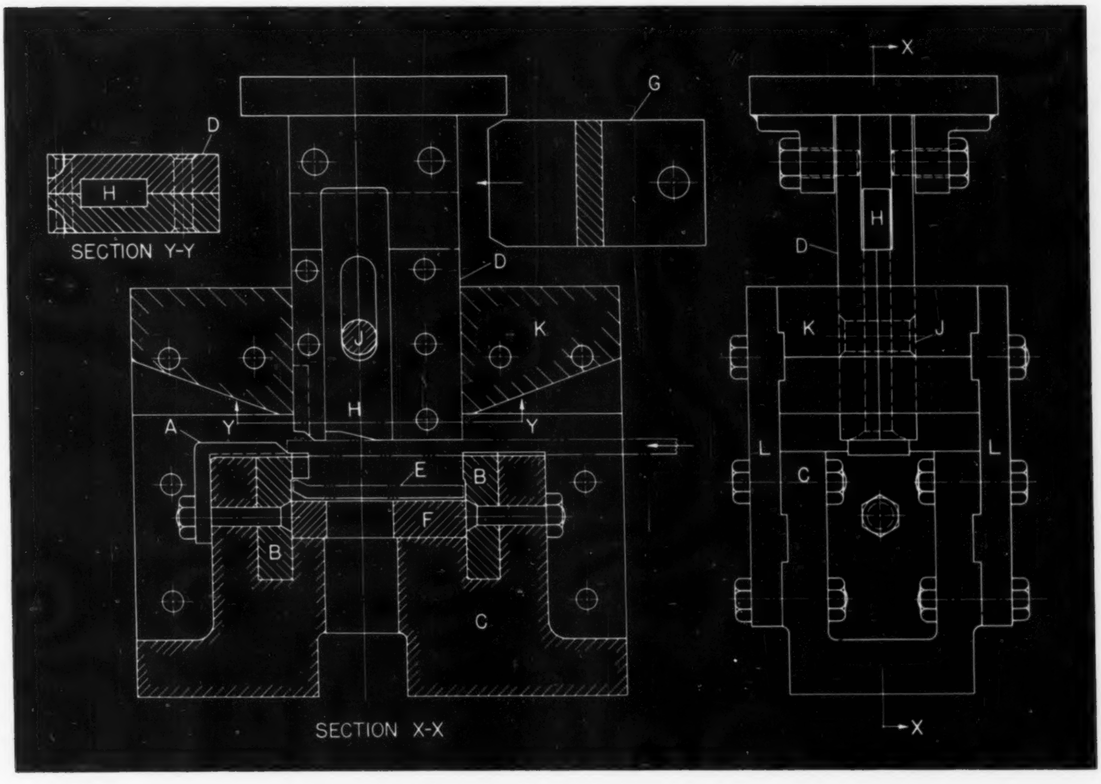
Floating Punch is Feature of Unique Die

A. G. Amos, Calcutta, India

Door-bolt hasps are produced in two strokes of the press ram with the die here illustrated. An outstanding point of interest is that the work-pieces are both sheared to length and pierced while in the same die opening. The two steps are made possible by employing a floating punch for the second operation which retracts fully into the main punch during the first press operation.

Lengths of flat stock 2 inches wide by 1/2 inch thick are fed against the die stop *A* in the direction shown in Fig. 1. Shear blades *B* that are fitted to the die-block *C* and punch *D* serve to blank the work-piece *E* on the first stroke of the ram. This punch also curls one end of the

Fig. 1. Die for door-bolt hasps incorporates a floating punch to complete the work-piece in two strokes of the press ram.



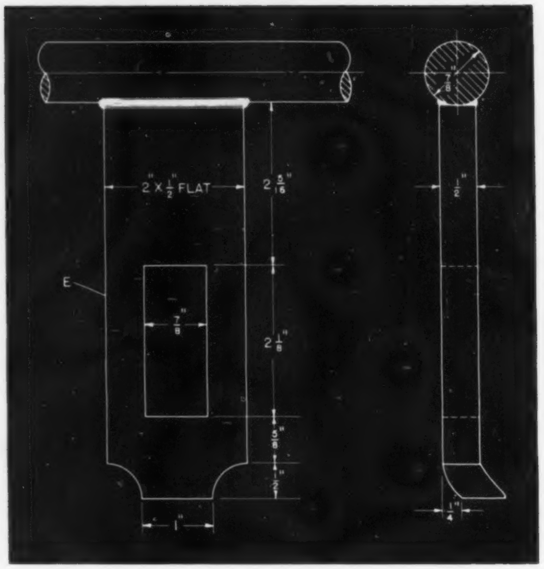


Fig. 2. Details of door-bolt hasp that is both sheared and pierced with the die shown in Fig. 1.

blank and drops it into a 3/16-inch deep cavity in the die-plate *F*.

Upon raising the press ram, bar *G* is inserted into a recess in the main punch to back up the floating punch *H* on the second stroke. This punch then descends with the ram to pierce the hasp as it remains in position on the die-plate. The completed hasp is shown in Fig. 2.

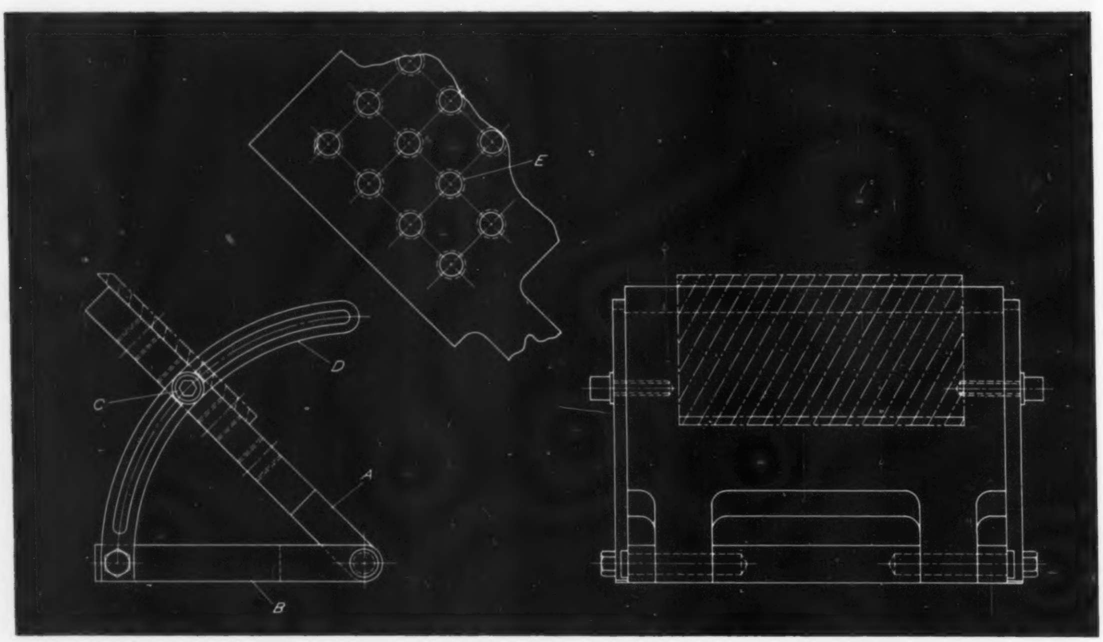
The outer punch, for facility of manufacture, is made in two halves. Each half is grooved to form a portion of the rectangular hole that receives the floating punch. Rivets hold the two halves together. A pin *J* secured to the main punch extends through a slot in the floating punch to limit its motion. Alignment is insured by guides *K* which are secured to the die-block by plates *L*.

Adjustable-Angle Grinding Fixture

F. L. Rush, Woodbourne, N. Y.

A simple grinding fixture that will support work at an angle to the wheel is shown in the accompanying illustration. Main part is a swivel plate *A*, on which the work is supported.

One edge of the swivel plate forms a hinge with base *B*. Angle adjustment is provided by the setting of cap-screws *C* in slotted quadrants *D* fixed to opposite ends of the base. The surface of the swivel plate has a series of tapped holes *E* to receive bolts for the straps used to hold down the work. Initially, the swivel-plate angle can be obtained with a bevel protractor.



By loosening cap-screws (C), swivel plate (A) can be raised or lowered in quadrants (D).

MACHINERY'S PROBLEM CLINIC

Mathematical problems in shop work and tool design submitted by readers of MACHINERY

Edited by HENRY H. RYFFEL

Angle of Tangent Between Two Radii

WALTER R. WISE, Design Engineer

Finding the angle of the tangent between two radii is a problem frequently encountered in design layouts. The problem and the construction required for its solution are shown in the accompanying schematic diagram.

SOLUTION:

To determine the angle α of the common tangent it is necessary first to compute angles β and γ and distances L and M.

1. $\cot \beta = \dfrac{C}{D}$
2. $L = C \sec \beta$
3. By proportion,

$$\frac{A}{M} = \frac{B}{L-M}$$

$$M = \frac{AL}{A+B}$$

4. $\sec \gamma = \dfrac{M}{A}$
5. $\alpha = 90^\circ - \beta - \gamma$

Example 1: Radii A and B are 2 and 4 inches, respectively; $C = 10$ inches; and $D = 5$ inches. Find α.

1. $\cot \beta = \dfrac{10}{5} = 2$

$\beta = 26^\circ 34'$

2. $L = 10 \times 1.1180 = 11.180$
3. $M = \dfrac{2 \times 11.180}{2 + 4} = 3.7267$
4. $\sec \gamma = \dfrac{3.7267}{2} = 1.8633$

$\gamma = 57^\circ 33'$

5. $\alpha = 90 - 26^\circ 34' - 57^\circ 33'$

$= 5^\circ 53'$

Example 2: Radii A and B are both equal to 4 inches; $C = 10$ inches; and $D = 5$ inches. Find α.

1. $\cot \beta = \dfrac{10}{5} = 2$

$\beta = 26^\circ 34'$ as in Example 1.

2. $L = C \sec \beta$

$= 10 \times 1.1180$

$= 11.180$ as in Example 1.

3. $M = \dfrac{AL}{A+B} = \dfrac{4 \times 11.180}{4 + 4}$

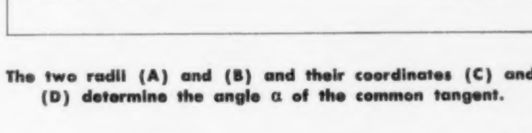
$= 5.590$

4. $\sec \gamma = \dfrac{M}{A} = \dfrac{5.590}{4}$

$= 1.3975$

$\gamma = 44^\circ 19'$

5. $\alpha = 90 - 26^\circ 34' - 44^\circ 19' = 19^\circ 7'$



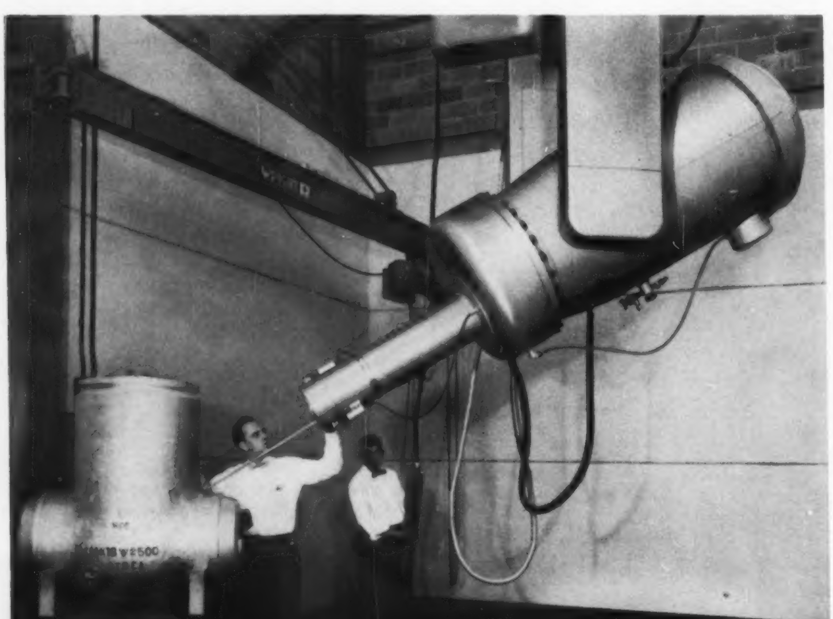
The two radii (A) and (B) and their coordinates (C) and (D) determine the angle α of the common tangent.

IN SHOPS AROUND THE COUNTRY

Camera highlights of some interesting operations performed in various metalworking plants throughout the nation

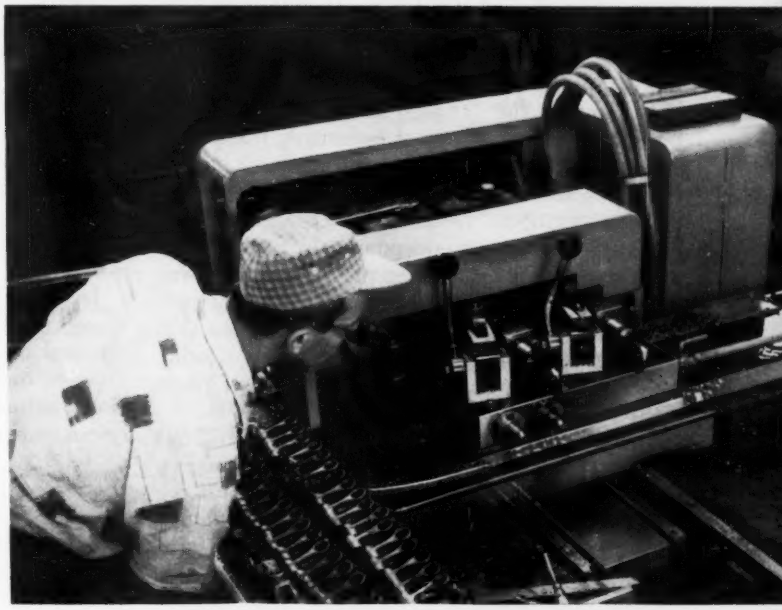
PUSH-BUTTON DRILLING—More than 200 precision holes are drilled in aluminum gear-boxes on this Fosmatic jig-borer, installed at the Triangle Tool Co., Union, N. J. In setting up the job, the operator adjusts two drum dials according to dimensions on the part blueprint. At the press of a button, the table positions itself on *X* and *Y* coordinates to within 0.0001-inch accuracy.

GIANT X-RAY—Setting up a valve-body casting for radiographic inspection in the new testing facility of the American Chain & Cable Co., at Reading, Pa. The equipment is a 2,000,000 electron volt Van de Graaff X-ray generator. The casting, having a 7-inch thick wall, is supported on a turntable which is indexed between exposures. Walls and doors on the building housing the generator are 48 inches thick.

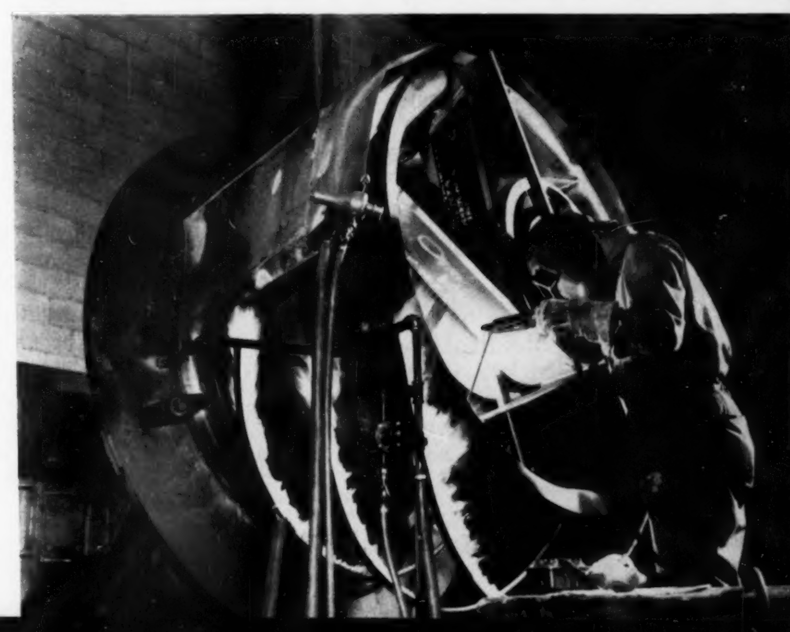


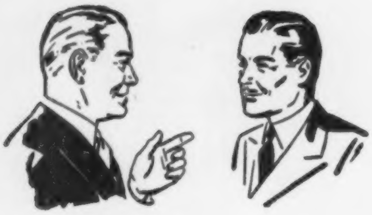
VIBRATION-FREE ARBOR — Milling three slots in molybdenum-steel rings at the Northrop Aircraft Co., Los Angeles. The staggered-tooth side-milling cutters are mounted on the arbor of a Cincinnati horizontal machine. The operation is performed rapidly and without vibration with the aid of a Sonnet roller bearing in the arbor's outboard support.

THREE-SPINDLE SPEEDSTER — At the Cummins Engine Co., Columbus, Ind., rocker levers are bored and faced on this three-spindle Heald Bore-Matic equipped with a hydraulically shuttling fixture which accommodates two work-pieces. Outer spindles each rough-bore and face one work-piece, operating alternately as fixture shuttles in each cycle. Central spindle finish-bores other work-piece.



FLAME THROWER—Gas flames from perforated pipes create rings of fire to prevent cracking during welding at the R. C. Mahon Co., Detroit. In the operation, hub and vanes are welded to a chromium-molybdenum steel gas-turbine cyclinder. Work, mounted on rotating table, later is stress-relieved and finish-machined.





Talking With Sales Managers

BERNARD LESTER
Management Consulting Engineer

Are We Selling Reliability?

FOR THE FIRST TIME during years of peace, Washington reports that the expense of furnishing products has now been exceeded by the total expense of supplying various services. This shows that although we continue to produce more things, and these in greater variety, the job of keeping them going has stepped ahead even more rapidly.

Of course, the "things" made by machinery builders consist of an ever increasing number of elements, and the failure of one of these usually results in the uselessness of all.

Sales engineers have always recognized the necessity of keeping equipment up to date. But a lot of changes have taken place in the requirements for dependability and the means of providing it. So many innovations have arisen that today sales people can be found who need a better grasp of what can make a customer place greater trust in a machine and its elements.

Few words in our language are tossed about more rashly than "service." The prime concern of the user of any machine is reliability. If we understand what reliability implies, and identify its various components, we can set up a sales organization that will continue to build sales.

Operating dependability to a user rests largely on four considerations: the design and construction of the machine sold, the environment in which the equipment works, tests and inspections, and the purchaser's opinion of what to expect.

At first glance these factors seem obvious. But what should interest us is that reliability is not a fixed trait. It clings to a trade name as well as to a type of machine. It extends far beyond the essential framework of engineering and manufacture. It depends on people's opinion and judgment—an area for sales proficiency.

Since the sales department has direct contact with users and knows their likes and dislikes, it can help guide design and construction. It must be familiar with all sorts of component parts of other manufacturers, which are now a part of the machine assembly.

Is your sales and service organization equipped with a simple and effective way of getting customers' opinions and presenting them in concrete form to other departments?

The environment in which equipment is to work obviously shapes the job of every sales engineer. At one time only installation care and lubrication were needed to provide reliability. An instruction sheet was ample. How different today! For instance, atmospheric conditions, magnetic interference, and noise and materials-handling facilities may be items of prime consideration. As you thumb through technical advertising, just observe the variety of operating advantages claimed for each product!

Is your sales organization well-prepared to show customers how your equipment meets each unusual need in a way to insure reliability?

Since today's machines embrace many operations automatically performed, they need frequent inspection and tests by experts. Irrespective of who supplies this help to attain reliability, the job of the sales engineer is to make sure that the necessity for periodic inspection is made crystal clear, and that the need is met.

Is your instructional material simple, clear, and sufficiently complete? Is your method of informing operators adequate, and if necessary, have you a plan to select and train experts to maintain the equipment you sell?

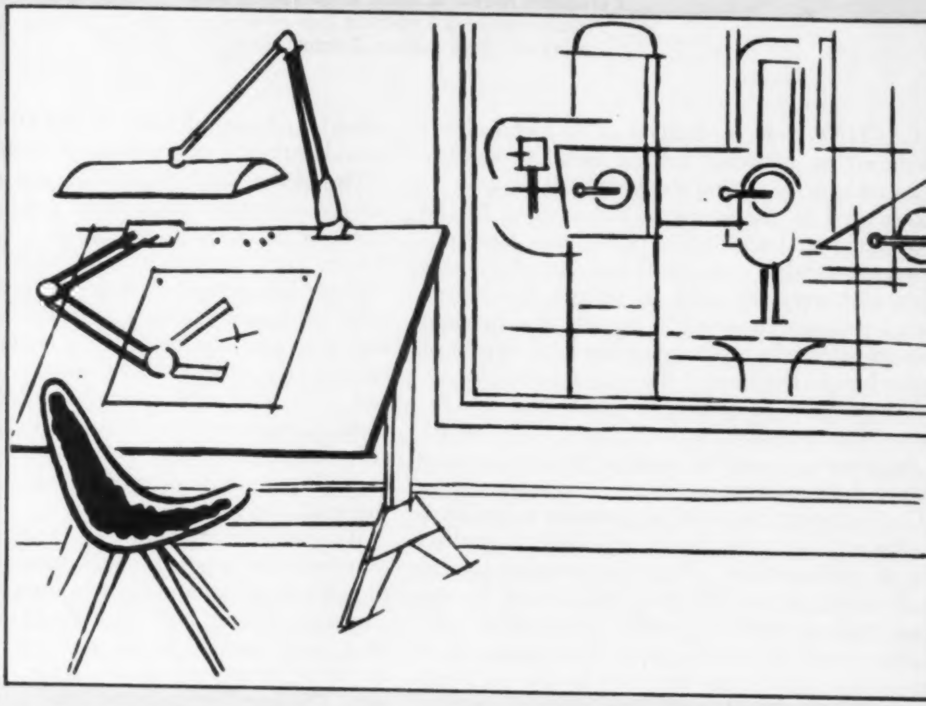
Reliability is a comparative term. Who would expect the battery in your car to last as long as the generator? If it fails you in its fourth year you may praise its manufacturer. With a basis for expectancy, the customer can calculate risks. Since much of the equipment we sell is newly designed and built, our job is to help the buyer make a reasonable prediction of trouble-free life.

In selling, do you stress telling customers what to expect in the use of your equipment so that their idea of its reliability will be realistic?

Is each sales engineer able to point out operating danger points and why they exist?

There is always some better way to make reliability real to customers and thus improve sales.

MACHINERY'S



WHAT THE DESIGNER SHOULD KNOW ABOUT PRODUCTION

November 1958

What the designer should know about production—Part 3

CASTINGS, CASTING DESIGN, and FOUNDRY METHODS

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A CASTING may be defined as "a metal object produced by allowing molten metal to solidify in a mold cavity so that its shape will be directly determined by the shape of the cavity." In the production of the 1958 line of Chrysler Corporation automobiles, over 1900 castings of various types and sizes are used. In weight, these vary from 1/4 ounce to over 230 pounds, and account for approximately one third of the total weight of a car chassis. Because of the variety, complexity, and importance of castings to the automotive industry, it is essential for the designer to be aware of the processes and limitations involved in producing these components.

Castings must not only be designed to function as desired, but must also be capable of production at minimum cost. Thus, every casting should be designed so that it is practical to cast, to machine, to heat-treat and finish, and to weld, bolt, or otherwise join to other parts if necessary. It is imperative, therefore, that the design engineer be well acquainted with the various casting processes and their proper applications. Such factors as dimensional tolerance, surface finish, machinability, castability of the materials involved, and over-all cost, should all be taken into consideration at every stage of casting design.

The oldest, least expensive, and therefore the most widely used form of all sand-mold casting methods is known as "green-sand molding." "Green sand" derives its name from the fact that it is used in an unbaked or green state. It contains necessary amounts of moisture to make it moldable and can be either a natural sand containing clay or a synthetic mixture of lake sand and bank sand with controlled additions of clay bond. Green-sand molds are generally not suitable for large or very heavy castings weighing over 500 pounds, depending of course on the shape of the casting.

When closer tolerances or greater rigidity are required than is possible with green-sand casting, the "dry-sand" method is employed. Dry sand is a mixture of sand and a bonding material which, after being molded to shape, is baked in an oven or otherwise treated to obtain the required hardness. The bonding material used is usually an organic material (core oil, resin, plastic, etc.) which will burn out at the temperatures of hot metal. The idea is that the mold or core will hold shape

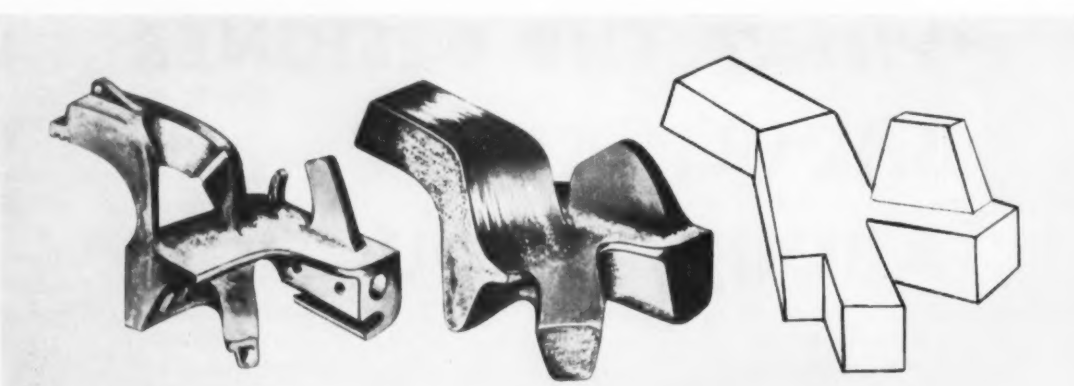


Fig. 1. An ideal casting as it might be visualized by a product designer is shown at the left; by a foundryman, center; and by a draftsman, right.

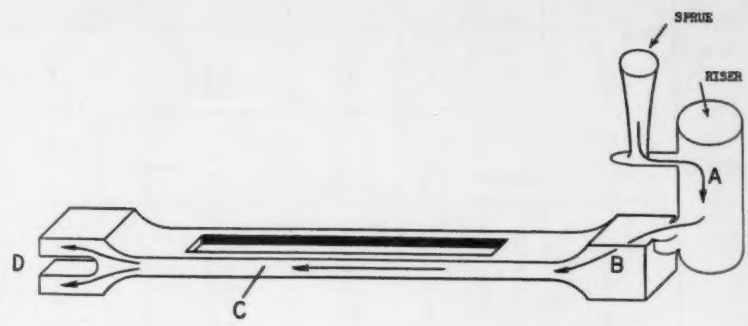


Fig. 2. Illustration of progressive solidification. Temperature of molten iron decreases as it passes through riser (A), mold cavity (B), and section (C) to the end of the casting (D).

long enough to allow the molten metal to solidify at the surface and, as the casting cools, the sand will crumble. Dry-sand molding is applicable to most large and very heavy castings.

The CO_2 process is a variation of the dry-sand molding technique in which mold hardness is achieved by a cold chemical reaction instead of by baking. The sand is mixed with a silicate organic binder. After ramming, the mold is hardened with carbon dioxide. The gas reacts chemically with the binder, forming a silica gel which hardens the mold. High metal temperatures here, as with other binders, will cause a breakdown of the organic material in the binder so that the casting can be shaken out.

A third form of sand molding is the shell molding process. In this method the material used as a binder for the sand is a thermosetting phenolic resin (made from phenol and formaldehyde). A sand-resin mix is either dumped or blown onto the face of a heated metal pattern. Heat causes the resin to melt and flow freely, thus bonding the sand grains together. After several seconds of dwell time, the excess, loose sand-resin mix is dumped off the pattern. A doughlike coating will adhere to the pattern. This is put into an oven for a period of from 20 to 90 seconds, where it will cure or harden as a coating or shell. The shell is then stripped from the pattern. A mold is made up of two such mating shells. Metal poured into such a mold will cause the resin binder to burn away slowly. Casting surfaces and dimensional tolerances possible with this technique are much better than with either green- or dry-sand methods.

Where extreme dimensional accuracy or fine surface detail are essential in the as-cast product, the process known as the "investment" or "lost-wax" method may be used. In this method a wax, plastic, or frozen-mercury duplicate of the casting is formed by pouring the liquid material into a split metal die, cooling to solidify, and then removing it from the die. The pattern can be an assembly of sections made in this way. This pattern is then dipped in, or sprayed with, a slurry of very fine refractory to build up a shell. Finally, the entire mold is placed into an oven where the pattern is melted and burned out, leaving a hard mold with a cavity having the precise shape of the pattern. No consideration for draft or parting line is necessary. The process is generally limited to small castings. Rate of production is low, and labor costs are higher than for most precision casting methods.

Permanent-mold casting makes use of a metal mold, similar to a die. The mold material is usually cast iron, coated or sprayed with carbon black or other material to prevent fusion of the casting to the mold. Dry-sand or metal cores are often used to form internal cavities. The process yields castings with a smoother finish, improved physical properties, closer dimensional accuracy, and less production scrap than is possible with green- or dry-sand methods. It is particularly good for non-ferrous alloys although it can be, and is, applied to smaller ferrous castings profitably. The rapid deterioration of the mold caused by high pouring temperatures of ferrous materials is the chief drawback when considering application to heavier castings.

The centrifugal casting process is similar to the permanent-mold process in that a metal mold is usually employed, although dry-sand molds can also be used. Dry-sand molds are, of course, expendable, but have the advantage of being capable of stacking so that many castings can be produced at one time on a common-center sprue. The castings can be of almost any shape, and may even be cored, provided they are laid out concentrically around the down-sprue and fed through gates or runners carrying the molten metal to the periphery of the mold. Such stack molding gives extremely good metal yield. The stack or cluster is poured vertically in a rotating

General Characteristics of Close-Tolerance Castings

Casting Method	Choice of Materials*	Tolerances, Inch per Inch, Plus or Minus		Cost Factors			Typical Rate of Production†	Time Required to Start Production (from Completed Design), Weeks	Size Range	Average Size of Castings, Pounds	Minimum Section Thickness, Inch	As-Cast Finish, Obtainable in Limited Areas, Micro-Inches
		Normal	Possible on 1 Inch Dimension	Labor	Equipment (Dies, Patterns, and/or Machines)	Casting Materials						
Precision sand	(4) Aluminum, magnesium, and bronze alloys. Use of ferrous uncertain as to dimensional accuracy.	0.005	0.003	Medium-high	Low	High	300 per month	4 to 6	Maximum size not known. Present production runs from under 1 pound to parts 6 feet in length.	1 to 4	0.050	75 to 80
Shell mold	(1) Any castable alloys, though mostly ferrous being cast.	0.005 (0.010 across parting line)	0.003	Low	Medium-high	Wide range	60 per hour	4 to 6	1/2 to 800 pounds	20 to 30	0.070	60
Plaster mold	(5) Aluminum, magnesium, and some copper-base alloys. (Melting point below 1000 degrees C.)	0.005 (0.010 across parting line)	0.005	Medium-high	Low	High	4 to 5 per hour	4 to 6	Under 1 ounce to over 100 pounds	3 to 5	0.040 to 0.060	50
Gravity die	(3) Aluminum, magnesium, and copper-base alloys.	0.015 (overall on small dimensions)	0.005	Medium	High	High, nonferrous; low, gray iron	30 per hour	6 to 12	1 ounce to 600 pounds	1 to 10	0.090	100 to 125
Pressure-die	(5) Aluminum, magnesium, zinc, some copper-base alloys, tin, and lead.	0.005 (0.010 across parting line)	0.002	Low	High	High	75 to 150 per hour for aluminum, magnesium, or copper alloys; 300 to 350 per hour for zinc alloys.	8 to 14	Under 1 ounce to 75 pounds in aluminum. Under 1 ounce to 200 pounds in zinc.	1/2 to 1	0.050	50
Investment	(2) Any castable alloy.	0.005	0.003	High	Varies with quality of pattern die necessary.	Wide range	Generally low. Higher with plastic pattern.	4 to 6	Under 1 ounce to 25 pounds in wax or plastic, and over 100 pounds in frozen mercury.	Up to 1	0.030	60 for wax and plastic; 40 for mercury.

* Numbers in parentheses represent relative range of choice in selection of materials: (1) = widest choice, (2) = narrower choice, etc.

† These figures are general for one set of equipment. Actual rate of casting production would depend on number of cavities per mold.

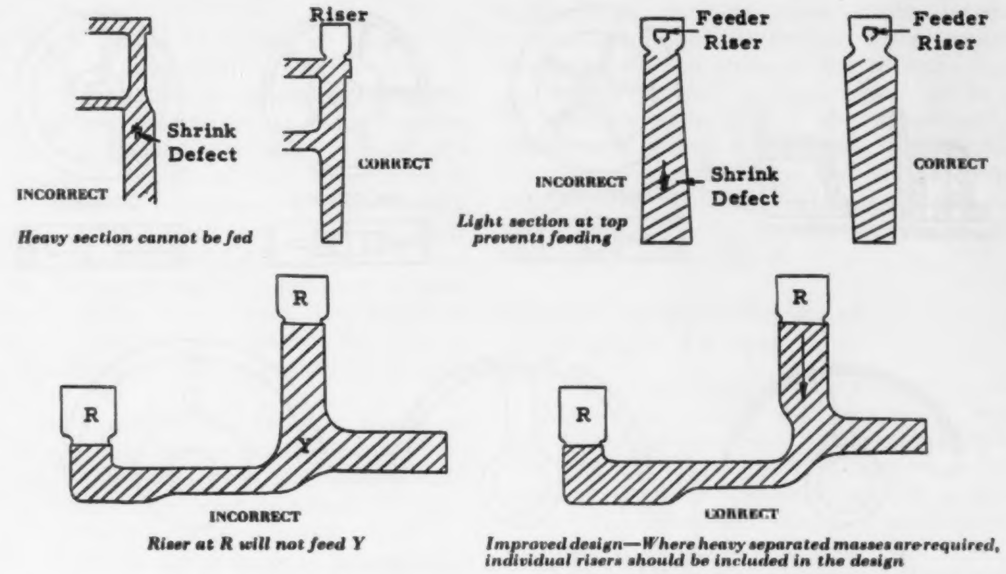


Fig. 3. Examples of correct and incorrect designs to insure soundness of casting sections. Thickest sections should be closest to risers.

mold. When metal is poured into a coreless, rotating metal mold either vertically or horizontally the resultant casting is a true centrifugal casting. Here the mold cavity is formed by centrifugal force alone. The quantity of metal is closely controlled by weighing the ladle before pouring, thus determining the wall thickness of the casting. All of the metal goes into the castings, since no gates or risers are formed, nor are any cores used to form the inner cavity walls. This method is employed primarily in the cast-iron pipe industry where pipe to 36 inches in diameter, and in standard lengths of 12, 16, and 18 feet are cast centrifugally in a water-jacketed steel die revolved on its axis horizontally.

Centrifugal force is also employed to drive metal into a mold as, for example, with ceramic or plaster molds of small castings with fine detail. In such cases, complete filling of the mold by gravity alone is not allowed because of the high surface tension of the molten metal, and/or low permeability of the mold.

Die-castings are similar in many respects to permanent-mold castings. The basic difference is that in permanent-mold casting, the metal is poured statically, while in die-casting the metal is forced under pressure into the die cavities to form the desired cast part. The die-casting die will not, therefore, make use of risers or sand cores which can be used in permanent molds.

A comparison of the general characteristics of castings produced by various methods is given in the accompanying table.

An individual's personal idea of what an ideal casting would be like will depend on his particular field of responsibility. For example, Fig. 1 illustrates three versions of a casting as it might be pictured by a product designer, a foundryman, and a draftsman. The part that the product designer considered perfect might be a nightmare to cast. On the other hand, a part simple to cast might be costly to machine.

If curves were plotted on the same chart to show both the cost of casting and machining for different design variations, the optimum design from the standpoint of lowest total cost would be the point where the curves intersect. However, in many cases minimum cost cannot be the only criterion. Strength, hardness, deflection, machinability, appearance, castability, and other factors may influence the decision. It is important therefore, that the designer work closely with the manufacturing groups. The tool engineer must indicate where he wants locating points. and the foundryman can advise on details of design which will facilitate casting, eliminate coring, save on machining, insure the holding of necessary tolerances, avoid marking critical faces with gates, reduce foundry tooling costs, and otherwise assist in assuring sound castings.

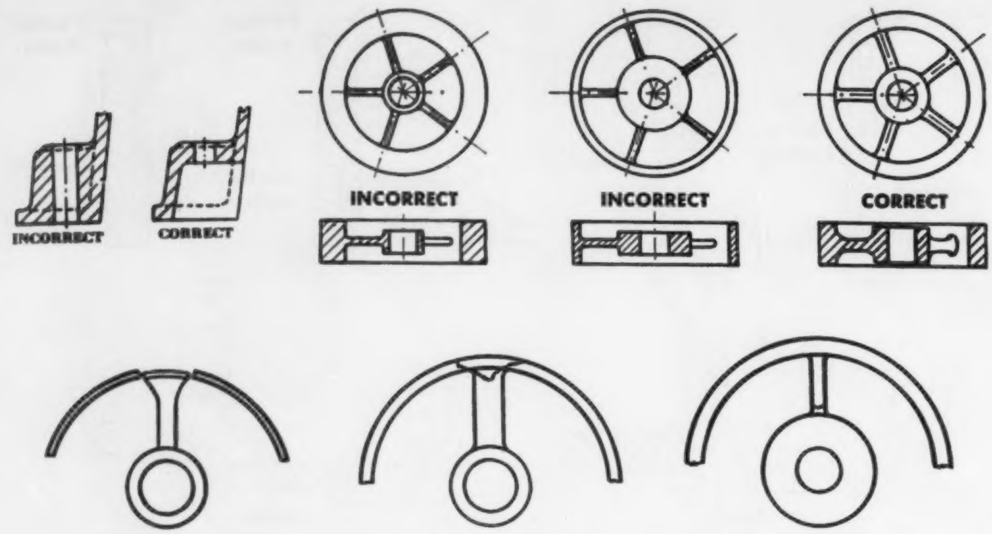


Fig. 4. Uniform, well-proportioned sections are important, as shown by feet at upper left and gear blanks, upper right. On correctly designed gear blank, the rim, spoke, and hub sections are well balanced. Pulley castings shown at bottom have improperly proportioned rims, arms, and hubs, resulting in cracking.

Generally speaking, castings may be classified in two design categories. The first includes applications where, due to low working stresses, the casting sections are determined by appearance, functional shape, clamping loads during machining, assembly pressures, or castability. The emphasis here is strictly on appearance and ease of manufacture. The second type of casting is designed to satisfy a physical or mechanical function. Here load stresses, impact, wear, vibration, corrosion resistance, heat distortion, electrical conductivity, and many other properties must be first taken into consideration in the material specification and in the design of such castings. Cost, ease of manufacture, and appearance are all subordinate and emphasis is on performance.

In order to minimize chances of designing a part which is difficult or expensive to put into production, there are numerous basic principles of good casting design that should be observed. These principles have been assembled as twelve rules, which, if adhered to by the designer, will help eliminate many production headaches.

Rule 1. Know Something about the Metallurgy of the Material

Physical properties vary in different sections of the same casting. For example, Brinell hardness readings taken in one section of a casting may be from 30 to 40 units higher or lower than those taken in another section. Also, one section can be four to five thousand psi stronger than another. Severe stresses and cracks often occur in specific sections of a casting, while other sections of the same casting may show porosity and shrink-cavities on machining. An understanding of metal solidification and cooling rates is necessary in order to appreciate that these variations occur according to definite laws and are not necessarily the result of poor casting practices.

Metal shrinks as it cools and solidifies from the molten stage. The patternmaker compensates for this shrinkage in producing the pattern. Metal of a given analysis, when cooled at different rates, can have widely different physical properties; and two metals of different analysis cooled at different rates can have physical properties that are similar.

Rule 2. Design to Compensate for Metal Shrinkage

Changes that occur in the process of cooling also have an effect on the amount of volume shrinkage that takes place in the metal. For example, harder irons shrink more than softer irons. The foundryman compensates for this shrinkage through the application of risers, which are reservoirs of supplemental metal that remain

liquid and feed the contracting metal in the casting as it solidifies.

Advantage should be taken of progressive solidification in compensating for shrinkage in a casting. This is done by arranging the gating system so that a specific section is far removed from an in-gate. Thus, the metal flows over a large area of the mold and loses temperature to the mold as it flows to that section. Consequently the metal in the removed section has a low temperature, while the metal that follows, flowing over the preheated mold surface, has a correspondingly higher temperature. This results in progressive solidification toward the pouring basin, which then acts as a feeder. An example is seen in Fig. 2.

Whenever possible, the designer should see that all members of the casting increase progressively in thickness to one or more suitable locations where risers can be placed to supply the metal required. Illustrations of correct and incorrect methods of designing to assure soundness of section are shown in Fig. 3.

When isolated heavy sections are not readily accessible for risering, it is still possible to obtain sound castings by resorting to the use of metal chills or mold inserts. Dependence on such special foundry techniques is poor practice for high-volume production, however, because of possible delay and increasing cost. It is always better to insure that any heavy section of a casting will be accessible for feeding by proper design.

Rule 3. Avoid Cracks or "Cold-Shuts" by Maintaining Proper Wall Section

Sections should be of minimum thickness, consistent with good foundry practice, and provide adequate strength and stiffness. Molten metal flows in various directions when entering a mold and, as the mold fills, this metal must fuse together. If the metal must travel too far, or the walls are too thin, the metal will not be hot enough to fuse together properly when it meets. The result is a "cold-shut"—a seam giving a weak spot in the casting.

Wall thickness in castings should be uniform wherever the design permits it. Walls of gray-iron castings and aluminum sand castings should not be less than 5/32 inch thick for smaller automotive castings, although the usual safe practice on most of our gray-iron work calls for wall sections averaging 13/64 inch thick. Wall thicknesses of malleable iron and steel castings should be not less than 3/16 to 13/64 inch, depending on size of part and method of casting. Walls of brass, bronze, or magnesium castings should not be less than 1/8 inch thick.

Sections of unequal size which do not blend gradually in thickness cause severe internal stresses and frequently produce actual rupture of the metal. This strain is due to more rapid cooling of the thin sections, which results in non-uniform contraction of the poured metal. Illustrations in Fig. 4 show how to avoid high cooling strains in the metal, and indicate proper blending between walls and bosses which is very important in reducing the stresses developed in the castings to a minimum.

Rule 4. Avoid Sharp Angles and Abrupt Section Changes

Sharp angles, abrupt section changes, or thin projections are conducive to mechanical weakness in castings because of the change of cooling rate at such points. Rounded corners and uniform sections, or properly tapered sections, should be maintained wherever possible—thus eliminating hot-spots or chills.

The junction of two intersecting planes represents such an area of weakness due to unbal-

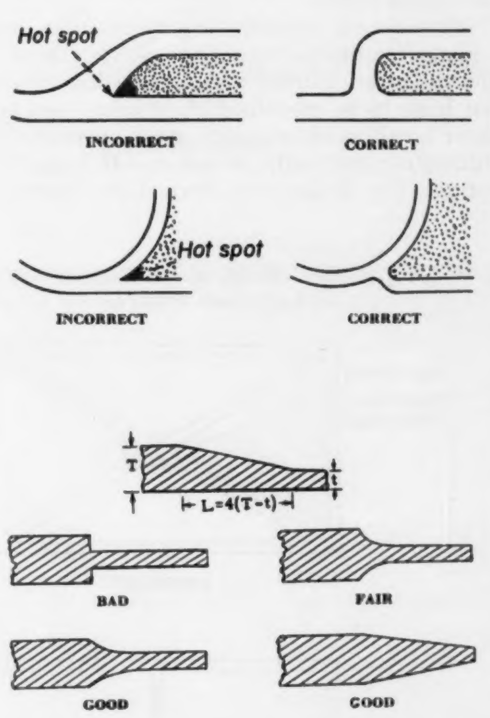


Fig. 5. Abrupt section changes should be avoided whenever possible in designing castings. Also, as seen at top, core designs that do not present cooling surfaces should not be used.

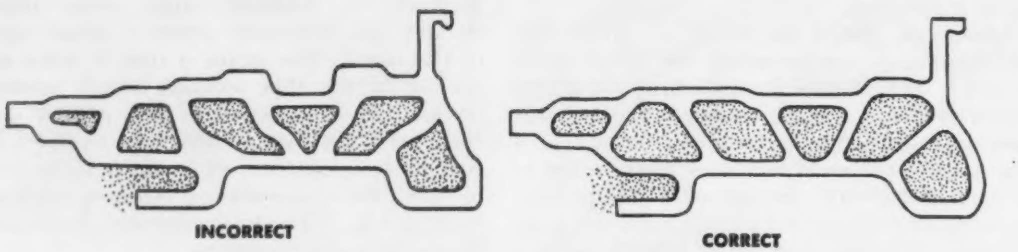


Fig. 6. Inner wall sections of complex cored castings should be of uniform thickness, but proportionately thinner than the outer walls, which cool faster.

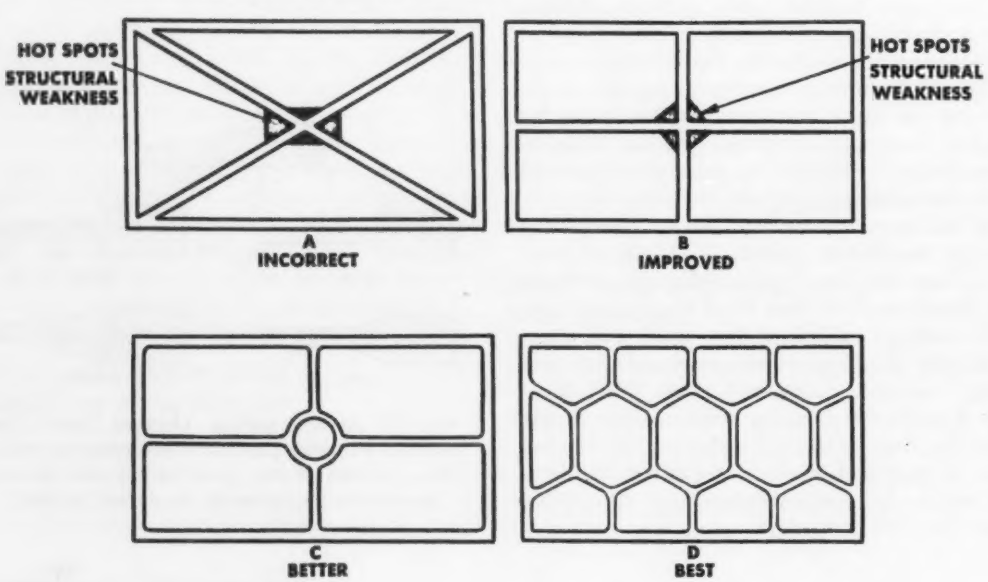
anced cell growth, or what is technically referred to as "dendritic growth." Heat concentration in this corner often results in a shrink-cavity. Even when such castings are successfully produced from a metallurgical standpoint, they always present a cleaning problem from burned-in sand. Adding a fillet in this corner allows for more balanced cell growth and more even heat dissipation. This is made possible through increased mold surface area.

Sharp outside corners are also injurious, particularly in thin sections, because they tend to chill the metal. Chilled edges on casting sections that have to be machined often cause tool and cutter breakage. A rounded corner prevents this. Chilling is particularly pronounced in large, thin sections. Fig. 5 illustrates correct and incorrect designs with regard to section changes. Core designs, seen at top, should present adequate cooling surfaces, and avoid sharp corners.

Rule 5. Proportion the Thickness of Inner Walls Correctly

Since inner wall sections of castings resulting from complex cores will cool more slowly than outer walls, they should be designed proportionately thinner, as shown in Fig. 6. Otherwise, since the outer wall has solidified first, the inner wall, having no supply of molten metal to draw from as it cools, will shrink and crack. Depending on the intricacy and shape of design, these inner walls should not be more than 0.7 to 0.9 of the outer wall thickness. Here again, sharp angles

Fig. 7. Ribs meeting at acute angles may cause molding difficulties and defective castings. The honeycomb design seen at (D) permits more uniform cooling of the casting.



should be avoided. Also long, slender cores surrounded by heavy metal sections should not be used.

Rule 6. Stagger Adjoining Web Sections Wherever Possible

Avoid localized slow cooling by not specifying large concentrations of metal. Stagger ribs or core web intersections to minimize hot-spots, distortion, cracks, and structural weakness. Also, avoid the use of ribs meeting at an acute angle, as seen in Fig. 7.

Rule 7. Eliminate Bosses, Lugs, or Pads Wherever Possible

Since bosses and pads increase the metal thickness, they tend to cause shrinks and should be eliminated wherever possible. When necessary, they should be blended into the casting. Undercuts should be avoided if possible, to eliminate unnecessary coring. When several lugs or bosses are located close together they should be combined into a single pad to simplify machining.

Rule 8. Minimize Necessity for Use of Cores

Cores should be avoided wherever possible because they require extra operations that add materially to the cost of castings, and necessitate wider tolerances in the part. Internal cores require adequate venting which must be done through the core prints in order to eliminate blow holes, gas pockets, and porous walls. Also, clean-out the removal of core sand, as holes must be provided for seen in Fig. 8.

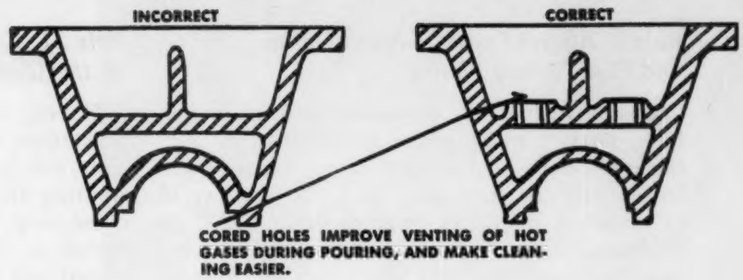


Fig. 8. Internal cores require adequate provision for removing gases, as well as means for the removal of sand in cleaning.

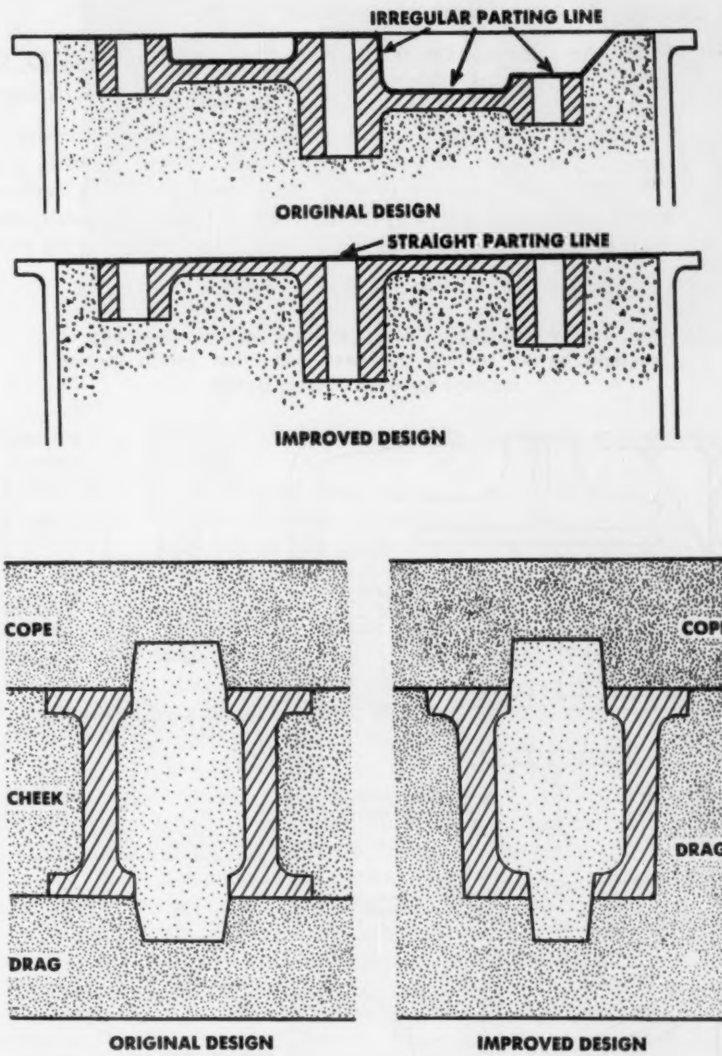


Fig. 9. Greater production at lower cost is possible if the casting design permits a straight parting line (top). Casting seen at lower left required three-part flask, while one at right needs only two.

Rule 9. Always Favor Compact Design and Flat Parting Planes

Castings which are unnecessarily long, or that have portions which protrude considerably from the main body of the part, often require extra large flasks, or they may limit the number of castings per mold. The casting should also be so designed that the mold can be easily parted in a flat plane. This will avoid isolated, thin, or weak sand surfaces that may drop or be damaged during pattern drawing or mold handling. As shown in Fig. 9, the cost of a casting will decrease as the design is simplified.

Rule 10. Allow for Machine Finish

In the construction of patterns for castings in which various points and surfaces of the casting will be machined, sufficient excess metal should be provided for all such areas. The amount of this allowance, commonly called "finish," depends on the type of metal used, the shape and size of the part, the tendency to warp, and the machining method and setup.

Rule 11. Construct a Full-Size Model of the Casting

Having carried through a design, it is a wise precaution to construct a model of the casting. This will help in visualizing the problems confronting the foundry and, eventually, the machine shop. It will show how the casting will be parted in the mold, how the cores can be designed and placed (or omitted), how metal will enter the mold, how solidification will proceed, and what the problems will be in cleaning the casting. The model can also be bolted to mating parts for checking over-all design, and to determine the possibility of combining them into one part.

Rule 12. Supply the Foundry with a Casting Drawing

Before issuing the final part print, make a casting print. Suggested designs for typical casting sections are shown in Fig. 10. Consult a foundryman or patternmaker relative to the following points:

1. Is the general design good? Can it be economically made in production?
2. Has allowance been made for metal shrinkage?
3. Can the casting be easily molded?
4. How many castings can be made per mold? Can a design change improve this?
5. Should cores be eliminated or simplified?
6. Is there sufficient provision for proper gating, risering, and venting?
7. Are part numbers and marks properly located?
8. Is there sufficient provision for cleaning?
9. Are specified dimensional limits reasonable?
10. In the machine shop, how can the casting be located, chucked, and easily machined?

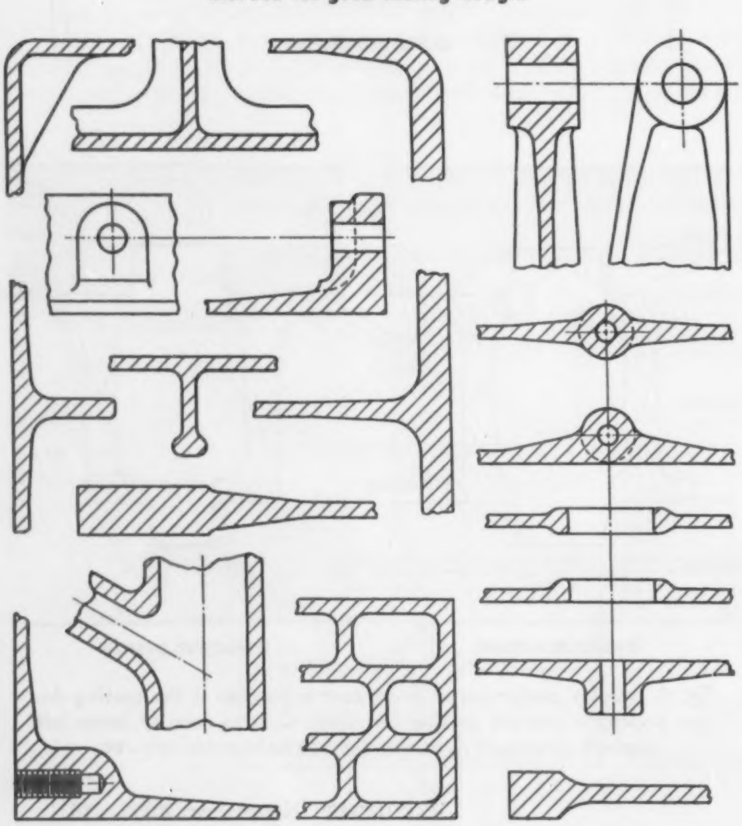


Fig. 10. Typical webs, clearances for machining, blending of sections having varying thickness, and other details recommended for good casting design.

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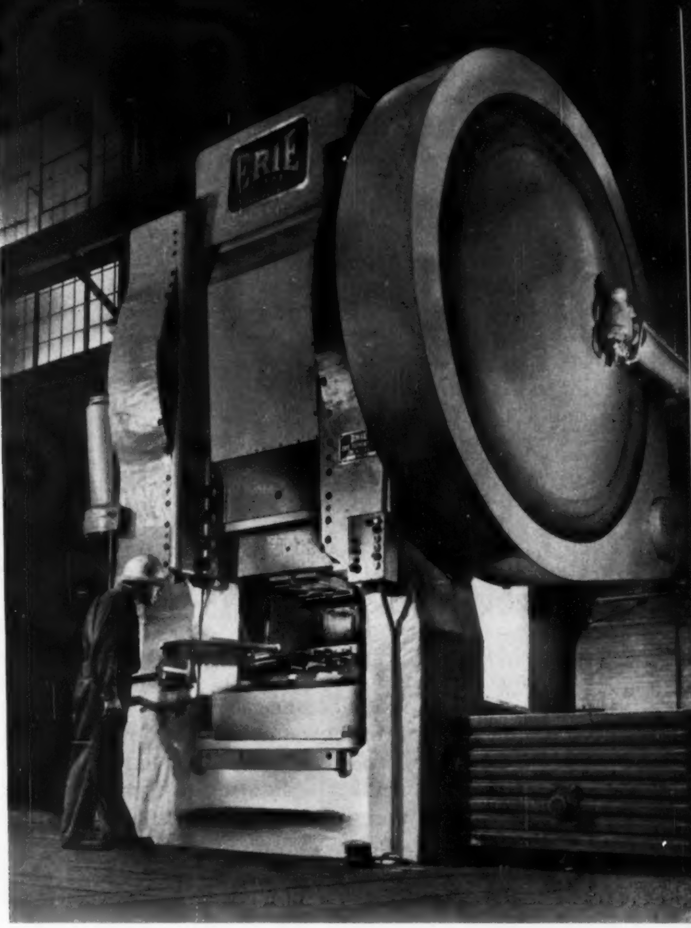
Fundamentals of Foundry Practice—prepared by International Harvester Co., Manufacturing Research Group, Chicago, Ill.

Handbook of Meehanite Metals, Bulletin No. 14 Seventh Edition—Meehanite Metals Corporation, New Rochelle, N. Y.

Automated Forging Press Delivers 1200 Track Links Per Hour



On the world's first fully automated forging press, the operator is merely an "observer."

A closed-die forging press in which workpieces transfer automatically from station to station is setting a phenomenal production record—and doing it with a minimum of manpower.

The 2500-ton press, built by the Erie Foundry Co., Erie, Pa., is designed for the high-volume forging of parts such as connecting rods, gear blanks, automotive and tractor valves, stem pinions, ring gears, track links, and wheel hubs. It has already undergone extensive testing in the builder's plant with a set of dies for crawler track links, forging them at the rate of 1200 per hour, and requiring the services of only one man. In contrast, only 275 of these same links could be forged per hour with three men on three hand-operated presses.

On this particular job there are a pick-up station, a semifinishing (blocking) station, and a finishing station. The change in the shape of the track link during forging appears in Fig. 1. At the left is the steel blank, 1 5/8 inches square and 8 1/2 inches long, as it is brought to the press after being raised to forging temperature; in the center is its shape after semifinishing; and at the right, its shape after finishing. Although not incorporated in this setup, a trimming operation can also be included in the press at another station.

Work progresses through the press from left to right. Blanks are heated in a furnace on the left side of the press in the heading illustration and are delivered by conveyor through an opening in the left side of the press. A pusher positions the blank at the pick-up station. In the close-up view of the die-bed, Fig. 2, one blank is shown on the conveyor and the preceding blank is shown at the pick-up station.

Next, a set of fingers move in and grip the blank and advance it to the semifinishing station, after which they move out. After the press cycles, the work in the semifinishing station, Fig. 3, is lifted off the die by knockout pins and advanced by a second set of fingers to the finishing station. Again the press cycles, and the piece in the finishing station, Fig. 2, is ejected and carried to a chute, from where it slides into a tote box.

The press cycles at forty strokes per minute and is capable of turning out a completed forging with every stroke. At this high rate of speed, however, die life would be seriously shortened by the heat of the work. To give the dies time to cool, therefore, blanks are fed on

Fig. 1. The crawler track link as it appears as a heated blank (left), after semifinishing (center), and after finishing (right).

every second stroke. This explains the absence of a work-piece from the semifinishing station in Fig. 2.

The fingers which grip and advance the work are mounted on arms, one arm being in front of the dies, and the other, behind. Since the linkage controlling the arm movement is outside the die area, the dies can be readily adjusted or changed. Power for the transfer mechanism is derived from the eccentric shaft of the press through a chain drive.

A relatively low over-all press height (only 11 feet, 3 inches) has been made possible by using a Scotch yoke instead of a pitman and ram pin. Circulating flood lubrication is provided for the main bearings, and the Scotch yoke operates in a bath of oil. Both the main gear and the pin are of herringbone design, of heat-treated alloy steel.

An air-operated, two-plate clutch is mounted on the main shaft, within the main gear. Bearings are mounted behind the clutch plate. The brake of the press can be adjusted from the floor. Made of cast steel, the wide brake band, with bolted-in lining, is hinged and reversible for long wear.

A dial gage indicates the stretch of the press housing during each stroke. A limit gage can be set to light a lamp if the stretch is more than desired. A design long used in other Erie forging units has been applied in this press, providing tapered auxiliary guides for the ram at the bottom of the stroke. This eliminates the guide pins found in other closed-die forging presses.

Fig. 2. The pick-up station and the two forging stations for this particular job are spaced 8 inches apart. Cams in transfer mechanism can be changed to adjust length of movement.

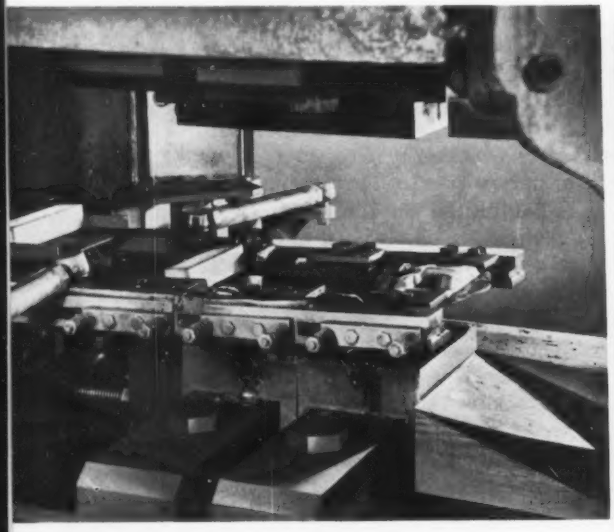
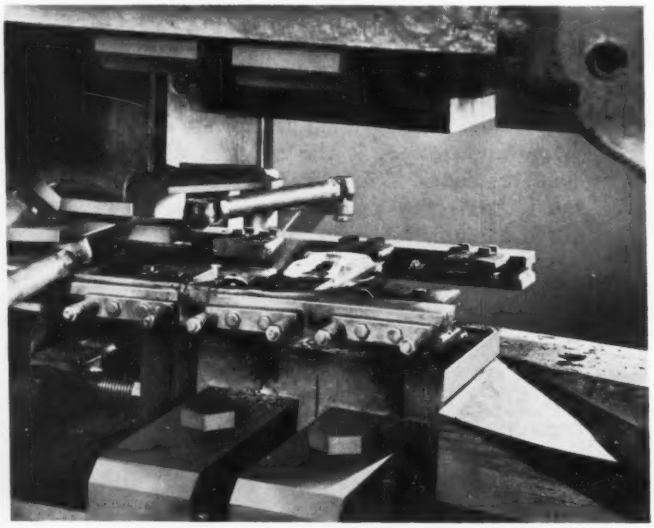


Fig. 3. The gripping and transferring movements are mechanically generated, thus accurately timed. The kick-out pins which remove the forgings from the dies are operated from a cam on the eccentric shaft.



MATERIALS

The properties and new applications of materials used in the mechanical industries

Utility Grade of Pre-Plated Steel Available for Trim

A low-cost utility grade of pre-plated steel has been made available by American Nickeloid Co., Peru, Ill., providing manufacturers with a material that can be used for trim or functional parts. Called "C-grade Steel Base," this material is available in pre-plated finishes of chromium, nickel, and copper on a steel base. It requires no cleaning, plating, or polishing and is readily adaptable to standard production techniques such as stamping, blanking, bending, welding, and seaming, without damage to the pre-plated finish.

The product is available in sheets, coils, and flat strips, in thicknesses ranging from 0.008 to 0.036 inch.

Tear-Proof Drafting Medium Provides Permanence and Wearability

The announcement of the development of "Dietzgen Ageproof Film," a tear-proof drafting medium which withstands considerable usage such as repeated erasures, folding, and handling, has been made by Eugene Dietzgen Co., Dept. M-2, 2425 N. Sheffield Ave., Chicago 14, Ill. Made from a virtually inert DuPont Mylar base, it is completely fungus-resistant, is impervious to perspiration, and is not stained by water. It has a tensile strength of 20,000 psi and a flex life of 20,000 cycles. The film is available with a plain surface and with diazo- and phototype-sensitized surfaces.

Ceramic Work-Holding Devices that Facilitate Fusion Joining

Custom-made jigs, fixtures, support rings, and work-holding devices with good thermal shock resistance and dimensional stability have been made available by the American Lava Corporation, Cherokee Blvd. and Mfrs. Road, Chattanooga 5, Tenn. These work-holding devices facilitate induction heating, brazing, welding, soldering, and other manufacturing processes involving high temperatures. One of these ceramics, generally used for short runs or small quantities, is known as "Grade A Lava." This ceramic, which is available in blocks up to 6

The custom-made work-holding devices shown here are made from AlSiMag ceramic and Grade A Lava and are available from American Lava Corporation, Chattanooga 5, Tenn.

inches by 12 inches by 20 inches, may be cut to very accurate dimensions with tools ordinarily used for working wood or soft metals. Once shaped, the ceramic may be hardened by heat-treating or it may be used in the unfired state.

Where larger quantities are involved or where particular physical, electrical, and chemical factors are present, the second material, "AlSiMag" ceramic material, is used to produce the work-holding device. The AlSiMag ceramic work-holding devices are manufactured to individual specifications, then fired and shipped to the customer ready for use.

Aluminum Sheet Alloy with Super-Bright Anodized Finish

An aluminum sheet alloy designed to make available a super-bright anodized finish has been announced by the Aluminum Company of America, 730 Alcoa Building, Pittsburgh 19, Pa. When polished, brightened, and anodized, this alloy, which is designated "Alcoa Alloy X5457," offers a lustrous mirror-like appearance. Its brightness makes it particularly adaptable in the automotive and appliance industries.

Control Tape for Automatic Programming Equipment

An extremely thin, high-strength, vulcanized fiber tape designed for use on tape-controlled automatic programming equipment has been announced by National Vulcanized Fibre Co., 1058 Beech St., Wilmington 99, Del. Known as "Peerless" control tape, this product is made of smooth, 0.005-inch thick, slate-gray vulcanized fiber which combines high tensile and bending strength with flexibility. It has a tensile strength of 6000 psi, high density, low porosity, good abrasion resistance, and is easily punched. This tape will not stretch out of shape during use. Its low coefficient of friction and freedom from impurities produces a minimum of wear on the perforating and feeding equipment associated with tape-control applications. It has an estimated maximum life of 1,000,000 cycles.

Economical Material Made Available for Whiteprint Reproductions

A low-cost emulsion and base for use in making positive intermediates and negatives employed in the printing of engineering whiteprint intermediates has been announced by Anken Chemical & Film Corporation, Newton, N. J. Known as "Supertransline," this product is printed by contact and can be safely handled in subdued light. Positive intermediates of this material are designed for use in diazo machines. Negatives can be used for printing on vellums, as well as wash-off and photo cloths. Developing is done in one to two minutes in long-lasting solutions of the D-72 type. The material comes in standard cut sizes and in rolls 36 inches by 100 feet and 42 inches by 100 feet.

Teflon-Lead Impregnated Bronze for Dry Bearing Use

A dry bearing material known as "DU" developed by the Glacier Metal Co., Ltd., of England and made in this country by a licensee, the United States Gasket Co., Camden, N. J., should find wide use in the automotive, appliance, industrial machinery, and aircraft industries.It is composed of a thin lining of spherical bronze, impregnated with a mixture of Teflon and 20 per cent lead, which is sintered to a steel backing.

This material has low friction characteristics, high wear resistance, high thermal conductivity and a low thermal-expansion rate. It has high compressive strength (up to 23 ton per square inch) and can operate in a temperature range of from minus 392 degrees F. to plus 536 degrees F. The material is available in strip form in a range of thicknesses from which bushings can be made, thrust washers cut, or hemispherical bearings pressed.

Heavy-Roughing and High-Velocity Carbide Grades Developed

Two new steel-cutting carbide grades have been developed to bridge the gap between high-speed steel and conventional carbides, for low-speed applications with severe impacts; and between conventional carbides and ceramics for high-speed finishing cuts. Designated "Wessonmetal HR" and "Wessonmetal HV," these grades can be used well into the speed, feed, and depth-of-cut ranges of conventional carbides.

Grade HR does not crater or chip readily under interrupted cutting conditions. This grade performs best in the cutting-speed range from 250 to 450 feet per minute. Grade HV produces good surface finishes. It has high red hardness and performs best at cutting speeds from 500 to 2000 feet per minute. These carbides have been announced by the Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

Hard-Facing Powder for Resisting Abrasion and Galling

A nickel-base, hard-facing powder containing tungsten carbide and chromium borides, which is applied to metal surfaces by the "Sprayweld Process," has been announced by Wall Colmonoy Corporation, 19345 John R St., Detroit 3, Mich.

"Colmonoy No. 75," as it is called, is well suited to applications involving wear caused by scrubbing action or metal-to-metal contact. The impact resistance, and oxidation and corrosion resistance of the treated surface are good, but tend to decrease somewhat at elevated temperatures. Applications include cylindrical parts, shaft sleeves, pump components, bushings, buffing fixtures, steady-rest jaws, and chip-breakers for cutting tools. The powder is not recommended for elevated-temperature applications where high oxidation resistance is a prime consideration.

Tough Nylon Air Hose with Recoil Action

A tough, lightweight, nylon air hose for use with pneumatic tools that incorporates snap-back action to keep it out of the way of work is being marketed by the Nycoil Co., Westfield, N. J. Called "Nycoil Hose," it is said to be heat-resistant and unaffected by oil, kerosene, or gasoline. It is recommended as a general-purpose air hose for industrial plants, machine shops, and gas-station lubrication rooms. The hose is made from Plaskon Nylon and is abrasion- and chemical-resistant.

The material is offered in 3/16-inch inside diameter and 1/4-inch inside diameter sizes in standard 25-foot lengths with flare fittings on each end.

Casehardenable Precision-Ground Steel Now Available

"Royal Precision Ground Low Carbon Steel," a flat ground stock which fills the need for an economical fine-finished steel for applications not requiring heat-treatment other than casehardening, has been made available by Vanadium-Alloys Steel Co., Latrobe, Pa. This steel contains about 0.18 per cent carbon and is furnished ground to a finish of 35 micro-inches or finer. It is easily machined and welded and is obtained in standard 24-inch lengths packaged in rust-inhibiting envelopes. The material is available in a wide range of sizes.

High-Temperature, Ductile Alloy with Impact Resistance

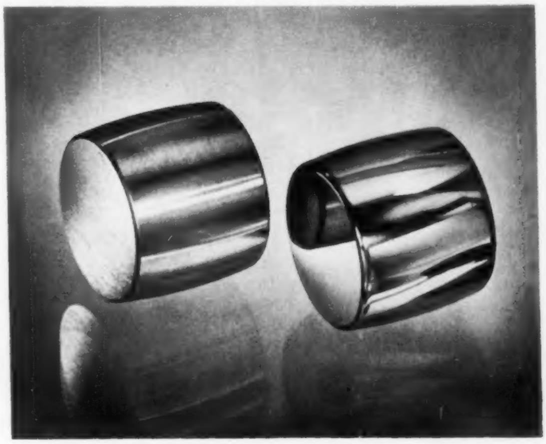
A high-temperature alloy steel known as Carpenter "Lapelloy C" has been developed by the Carpenter Steel Co., Reading, Pa., for jet-engine parts that require good ductility and impact resistance. The alloy has a homogeneous structure with a uniform fabrication behavior and uniform mechanical properties. It can be used for highly stressed parts involving service temperatures up to 1200 degrees F.

High mechanical properties can be developed by heat-treatment. It has good resistance to scaling and oxidation for continuous service up to 1400 degrees F., and offers its best corrosion resistance in the hardened and tempered state. In the annealed condition its machinabilty is comparable to Type 420 stainless steel. The alloy is available in billets, hot-rolled and cold-finished bars, wire, cold-rolled strip, and special shapes. Applications include compressor wheels, turbine shafts, compressor buckets, blades, and bolts.

Aluminum Alloy Developed for Extruding Structural Members

Extrusion ingot for structural applications has been made available by Aluminium Limited, Inc., 620 Fifth Ave., New York, N. Y. The alloy, called "Alcan B51S," would, after extrusion, be used for applications such as railings, decking, masts, and brackets, structural members of road vehicles, and electrical substations. The alloy offers capability of a high extrusion speed, good mechanical properties, and a good finish.

This illustration presents two high-alloy steel bearings. The one on the left shows the bearing before a barrel-finishing operation; the one on the right, a similar bearing after ten-hour finishing cycle in which the micro-inch reading was reduced to 2 rms (root mean square) from an initial 10 rms. The process, known as "Cor-A-Brite," has been developed by the Roto-Finish Co., Kalamazoo, Mich., and is completed with one chip mass in a standard barrel-finishing machine.



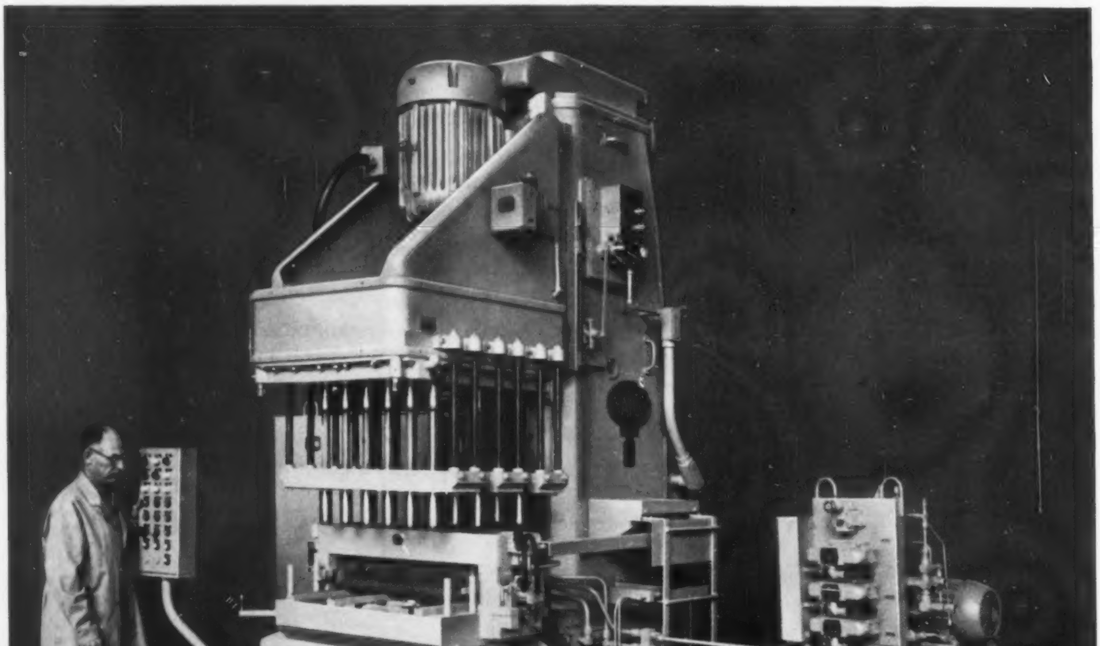
LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts and

Natco Multiple-Spindle Drilling Machine Designed for Exacting Production Job on Diesel-Engine Part

The National Automatic Tool Co., Inc., Richmond, Ind., has developed a multiple-spindle drilling machine designed to perform difficult machining operations required in the production of diesel engines. This unit, called the Natco C4A vertical Holesteel driller, is successfully handling the troublesome job of processing holes for fuel-injector bodies in the heads of both four- and six-cylinder diesel engines. Machining operations on these cylinder heads require special tools and must be performed with exceptional accuracy. This is necessary in order to confine pressures resulting from compression ratios as high as 17 to 1. Operations include machining a very critical seating surface located at an angle at the bottom of each hole, maintaining precise tolerances with respect to depth, form, perpendicularity, and microfinish.

Three sets of spindles are provided so that three operations can be accomplished automatically. Using about one-third of one operator's time, the production rate is about 15 parts per hour. This represents a saving of

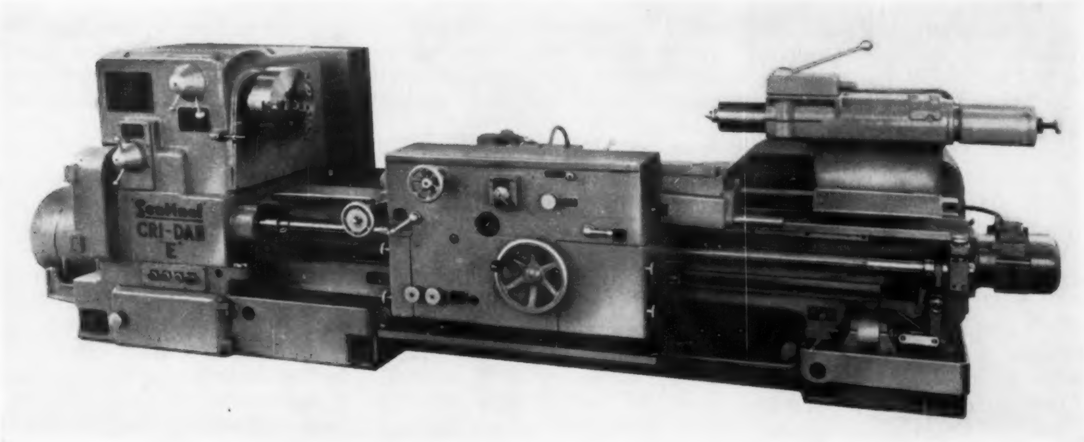


Natco multiple-spindle driller for finishing holes for fuel-injector bodies in diesel-engine cylinder heads

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by Freeman C. Duston



Cri-Dan Model E threading machine introduced in this country by the Gisholt Machine Co.

0.9 hour per part over the methods previously employed. Parts are loaded directly from a conveyor, located by two master dowel-pins and hydraulically clamped in the fixture. When the master-cycle button is pressed, all operations are performed automatically. In the first position, four or six holes are core-drilled and rough-formed at the bottom to an angle of 30 degrees by combination tools. The work is then indexed to the second position, where combination semi-finish reaming of the inside diameter, forming a 60-degree relief angle and semifinishing a 30-degree seat angle at the bottom on the holes is accomplished. Following this operation the work is indexed to the third position where the body holes are precision-reamed and finish-formed to a seat angle of 30 degrees. The work is then indexed to the first or starting position and unloaded. The specially designed fixture and an unusual bushing-plate arrangement assure accurate setup and close tolerances.

The automatic, three-position index-table is hydraulically operated front to rear. On this table is mounted a holding fixture which will accommodate either a four- or six-cylinder part. Included as an integral part of the fixture is a bridge type bushing plate with six master bushings. An independent, traveling type bushing plate is employed at each of the three working positions. Each bushing plate has six tool-guide bushings. As the head feeds down, the tool-guide bushings fit into the master bushings in the fixture.

Helical gear-driven spindles, plus accurate alignment of the spindles in relation to the holes being worked, allow more than 3000 parts to be produced between grinding of the carbide-tip cutting tools. The finish in the seat angle at the bottom of the hole is held to 40 micro-inches. Hole location is being held to ± 0.0005 inch and hole spacing, to ± 0.001 inch. This machine has a 28- by 36-inch cluster box head with eighteen spindles driven by helical gears. The power drive is a separate unit.

Circle Item 101 on postcard, page 189

Cri-Dan Semi-Automatic Single-Point Threading Machine

The Gisholt Machine Co., Madison, Wis., recently appointed exclusive United States distributor of the Cri-Dan threading machines, is introducing the Model E machine here illustrated. The single-point, carbide threading tool of this machine is cam-controlled and provides very accurate lead and thread form on all types of internal and external threads, including multiple-start, coarse, fine, left- or right-hand, parallel or taper, with metric or inch pitches.

This unit has a maximum swing over bed of 25 inches and will swing work 12 inches in diameter over the cross-slide. The machine has a standard bed length of 5 feet 6 inches. It is also available with an extra-long bed 8 feet 6 inches in length, or a short bed only 2 feet 6 inches long. The maximum threading length capacity is 6 1/2 inches. Maximum external threading diameter is 12 inches and maximum internal threading diameter, 16 inches. The

hole through the spindle is 3 inches in diameter.

The spindle has an A1-8-inch nose. Available spindle speeds in 32 steps range from 50 to 1400 rpm. Power is supplied by a 20-hp motor.

Circle Item 102 on postcard, page 189

Huge Gear-Shaving Machine

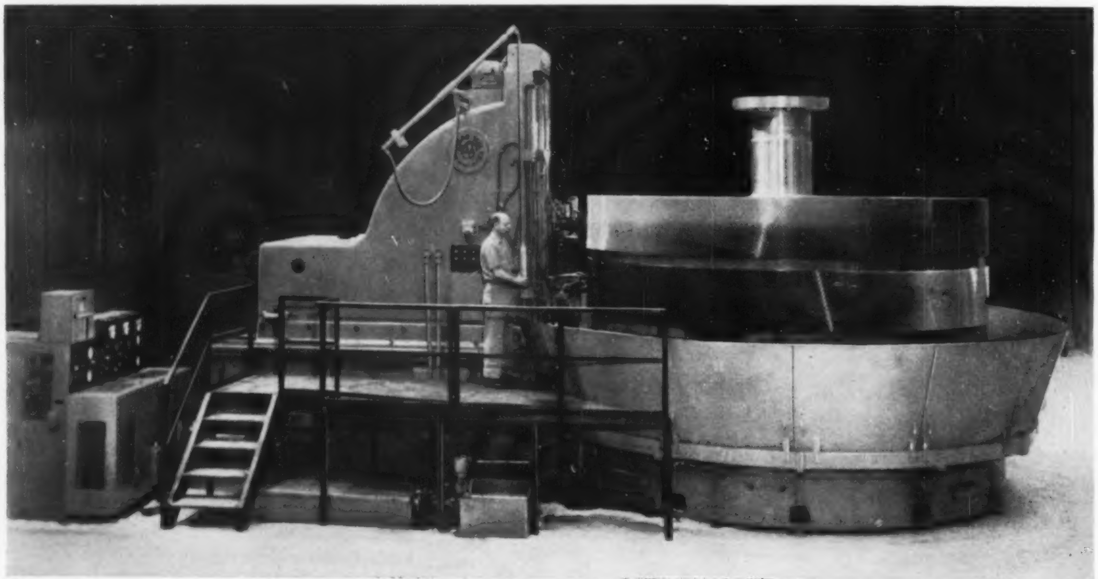
Large gears, ranging from 80 to 200 inches in diameter with face widths up to 74 inches, can be finished rapidly, accurately and economically on a giant-sized gear-shaving machine developed by the Michigan Tool Co., Detroit, Mich. This vertical machine, designated the V-200, is said to be the world's largest gear shaver. The work-supporting table rotates within 0.0002 inches of concentricity and is accurate within 0.0002 inches of runout in the flat plane of rotation. Accuracy is maintained even under maximum table loads of 150,000 pounds for the work-piece plus 50,000 pounds for the fixture.

This machine is now being used in the production of marine turbine-reduction drives for the General Electric Co.'s plant in West Lynn, Mass. Although designed specifically for this application, the unit is expected to find ready use in a wide range of big gear applications in the manufacture of railroad, power plant, ordnance, and roadbuilding equipment. Besides its broad capacity range, the V-200 is a highly versatile machine—it can shave either internal or external spur, helical or herringbone gears with or without integral shafts. Shaft sizes up to 40 1/2 inches in diameter (the hole size of the table) can be accommodated.

The manufacturing advantages claimed for this huge gear-shaving machine include: virtual elimination of costly and time-consuming lapping and extra finishing time; more precise control of the involute forms; and the ability to incorporate controlled-tip relief in the gear-tooth form so that interference of the teeth is avoided when the mating gears roll into mesh. The gear-tooth surfaces can also be finished as fine as 12 micro-inches as compared with an average of 40 micro-inches for lapped gears of comparable size. The new machine also makes it possible to reduce hobbing time because multiple-thread hobs can be used for roughing and semi-finishing large gears prior to shaving. Formerly, only single-thread hobs could be used before final lapping. Easier gear checking is another advantage of the shaving machine which is equipped with facilities for mounting checking instruments. Thus, the large gears can be continuously checked during the process.

For fast shaving, the V-200 is equipped with dual cutting heads that are independently adjustable to the correct angle. The upper cutter is also adjustable for height. Cutting time is substantially reduced by the use of two heads. This is particularly true with herringbone gears as each cutter shaves one helix face so that both helices are finished simultaneously.

80- to 200-inch gears are shaved by gear-shaped rotary cutters with serrated teeth that provide a series of cutting edges. Each cutter of both heads has a wide groove in its center section to make it effectively serve as a "two-in-one" cutter. This cutter design provides two shaving zones on each gear—with both shaving zones guiding and steadying the other. This is the guided shaving tool and is used optionally. The machine accommodates cutters from 7 to 12 inches in diameter and up to 3 inches in width. Cut-



Giant-size gear-shaving machine built by Michigan Tool Co., in operation finishing gears for marine turbine-reduction drives at the West Lynn plant of the General Electric Co.

ter-spindle hole size is 2 1/2 inches.

In operation, the shaving cutter is slowly reciprocated up and down across the face of the work. The rotary cutter and gear rotate in mesh, the work doing the driving. The mounting axes of the gear and cutter, however, are not parallel. With this crossing of the gear axis and cutter axis, each cutting edge sweeps in a shaving action across some part of the gear-tooth face as the gear revolves.

The hollow table, fixture, and work are supported by a pressure oil film which is adjustable to suit varying table loads. An inherent advantage of the vertical type machine is that the gear being shaved is located in the same position and on the same face as in the hobbing operation which originally generated the gear teeth. A secondary advantage of the vertical design is the elimination of errors caused by possible shaft deflections. The large (178-inch diameter) table is set on a massive cast-iron base, as is the vertical slide mounting.

The work-table driving motor is a 230-volt, direct-current, variable-speed type built to provide an infinite number of table-driving speeds from 0.93 to 15.16 rpm.

Circle Item 103 on postcard, page 189

Heald Internal Grinders Featuring "Rite Angle" Design

Two new internal grinders, introduced by the Heald Machine Co., Worcester, Mass., feature "Rite Angle" design in which the table is inclined at an angle of 30 degrees to the work. The inclined table prevents any tendency to lift when the work is fed into the wheel, achieving solid wheel backing to take heavy pressure. It also assures true table tracking, excellent swarf, and coolant drainage, as well as a base for mounting wheelheads.

The Model 180A roll type centerless internal grinder, Fig. 1, is designed for small to medium-size work that can be rotated on its own outside diameter. Work 3/4-inch to 4 1/2-inch outside diameter can be handled, and holes up to 3 inches long can be ground. Maximum included angle of taper on the Size-Matic type is 60 degrees. The base in contact with the floor is 50 inches long by 30 inches wide, while the complete unit requires a floor space only 80 by 80 inches.

The Model 170A chuck type internal, high-production grinder, Fig. 2, is designed for automatic chucking of small to medium-size work that cannot be rotated on its own outside diameter. This machine handles work with outside diameters up to 4 1/2 inches, maximum hole length of 2 inches, and maximum hole diameter of 2 inches. It has 10-inch swing inside hole and a 7 1/2-inch table travel. Measuring 50 by 30 inches, it can be located with coolant tank on a floor space of 86 by 80 inches. It is claimed that, given a proportionately stiff quill, the new machines can grind as fast as the wheel and work will take the load.

Heavy stock removal, possible with the new machines, permits fast grinding cycles with no sacrifice in accuracy or precision. Cost savings are realized on all sizes of work handled, but are most apparent in the larger sizes (up to 4 1/2 inches, outside diameter) where it is claimed grinding time can be reduced as much as 50 per cent, as compared with the time required by earlier machines.

Inclined table construction has been developed to combine the strength and rigidity of box type ways with V-way accuracy of alignment. Thrust forces against the wheelhead and table in heavy grinding are against the lower side of the gib or into a horizontal V-way. The lower way is simply a flat guide to keep the table straight.

Other design and operation fea-

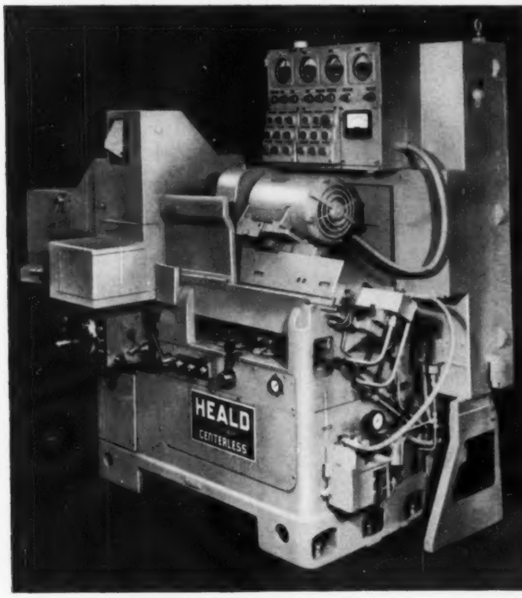


Fig. 1. Heald roll type centerless internal grinder

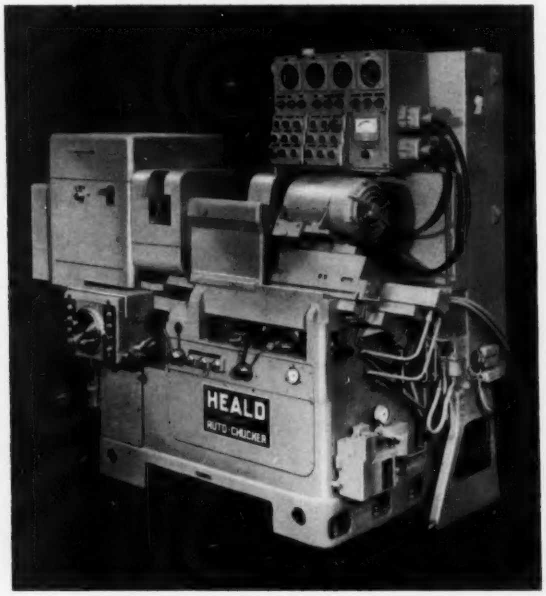


Fig. 2. Heald chuck type internal grinder

tures include: adequate clearance for diamond dressing units; simple adjustment for wheelhead height; infinitely variable hydraulic cycles; operation with high-frequency or belt-driven wheelheads; efficient swarf and coolant disposal; automatic feed control with self-adjusting diamond; solid plug or air sizing; and optional group or battery operation.

Circle Item 104 on postcard, page 189

Hamilton Open-Back Inclinable Presses

Open-back inclinable presses with 75- and 90-ton capacities have been introduced by the Hamilton Division, Hamilton, Ohio, of the Baldwin-Lima-Hamilton Corporation. These presses have been developed for high-speed production of small stampings, and are especially adapted for use in the automotive, electrical, and appliance industries.

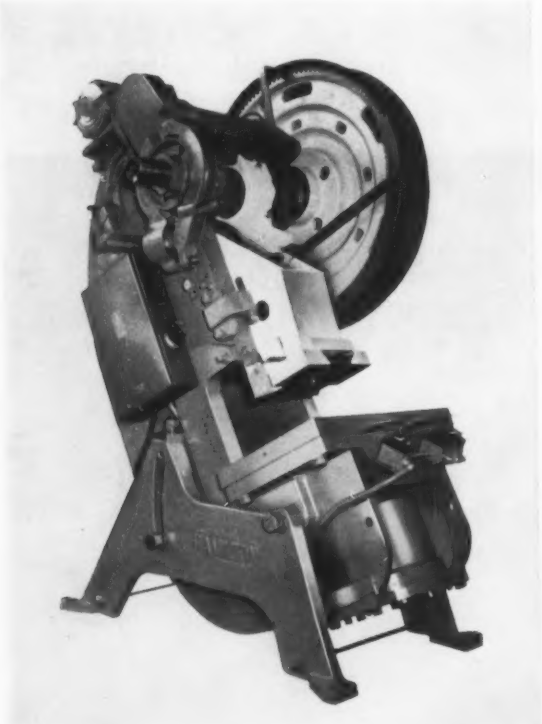
In addition to high-speed production, the open-back inclinable type press is economical in cost, can eject parts completely by gravity when inclined at the proper angle, and has wide-open accessibility for maintenance, servicing, and die changing. Outstanding features include: stress-relieved fabricated steel frame that reduces deflection so that 50 per cent more parts can be produced before the dies require reworking; air friction, disc type clutch that operates at low crankshaft speed rather than high driveshaft speed to minimize wear and heat generation; band type air-releasing brake that reduces wasted cycle time to provide maximum over-all production speed; square rear surfaces to take the crank thrust, and angular front surfaces that serve to facilitate adjustment.

The geared type presses operate at a maximum speed of 40 strokes per minute, and the non-geared type at 90 strokes per minute. Inclining devices, built into the right and left legs of the press, afford up to 25 degrees inclination from the vertical position. Accessories and auxiliary equipment available include pneumatic cushions, pneumatic counterbalances, automatic oil lubrication system, thermoguard, zero speed switch, and optional drive motors and electrical control systems.

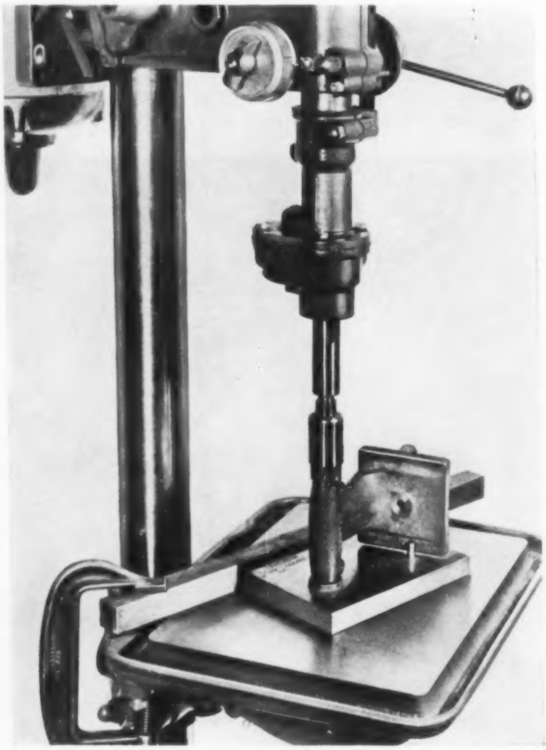
Circle Item 105 on postcard, page 189

Delta "Slo-Speed" Attachment for Drill Press

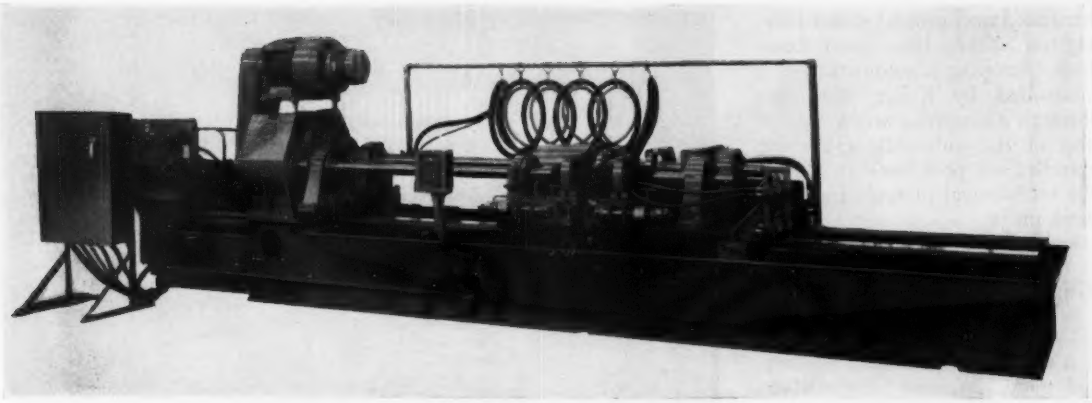
A "Slo-Speed" attachment which permits machine tool operations requiring slow speeds and positive drive to be performed on a 20-inch drill press has been introduced by the Rockwell Mfg. Co.'s Delta Power Tool Division, Pittsburgh, Pa. This special attachment, previously available only to fit Delta 17-inch drill presses, provides smooth, high-torque power transmission for a variety of operations such as spot-facing, reaming, counterboring, core-drilling, and cutting wooden plugs.



Hamilton 75-ton open-back inclinable press



Delta Slo-Speed attachment for drill press



Davis and Thompson tube-boring machine

A train of accurately machined, heat-treated, double-reduction gears eliminates chatter and slippage and gives positive, smooth operation. Using the five-pulley drive of the 20-inch drill press, the speed range is 70 to 1700 rpm with a motor having a speed of 1140 rpm and 105 to 2600 rpm with a motor operating at a speed of 1725 rpm. The reduction gears of the attachment have a ratio of input to output of 4.7 to 1. The spindle travel with the Slo-Speed attachment is 4 15/16 inches. The attachment is available to fit 20-inch Delta drill presses having either No. 2 or No. 3 Morse taper spindles, and for use with cutting tools having either No. 2 or No. 3 Morse taper shanks.

Circle Item 106 on postcard, page 189

Precision Drilling Machine for Pattern Shop

A versatile precision drilling machine expressly designed for use in modern pattern or model shops has been developed by the Leland-Gifford Co., Worcester, Mass. Built to the specifications of this company's patternmakers, the new drilling machine features an extra-large, plain-surfaced, tilt-top table; deep spindle nose to table capacity; heavy-duty spindle and quill; and wide speed range.

The table measures 40 inches wide by 23 inches deep, tilts to an angle of 45 degrees either side of the horizontal position and has a smooth top to facilitate work-handling during planing or milling operations. It is raised or lowered by a convenient hand crank with 29-inch maximum spindle nose to table distance (larger capacity available). Space between spindle and column is 13 inches.

Spindle and quill are of rugged, heavy-duty construction and equipped with combination radial-thrust bearings to take the side thrust associated with routing, planing, and milling operations. A sensitive hand-lever feed with ratchet gives precise control of feed and depth for drilling. The spindle can be set to depth and locked for accurate planing cuts.

Speeds from 150 to 3600 rpm are available through a four-speed motor and back gears. A conveniently located handwheel changes speeds and shifts gears without stopping the machine. Speed settings are indicated on an illuminated chart.

Other features include a built-in light to illuminate the table and work; foot switch start-stop motor control which leaves the operator's hands free; and counterbalanced sliding head for effortless vertical adjustment.

While this new machine has many features that adapt it to the woodworking needs of pattern or modelmaking shops, it is also fully capable of handling the metal or plastics drilling operations encountered in these shops.

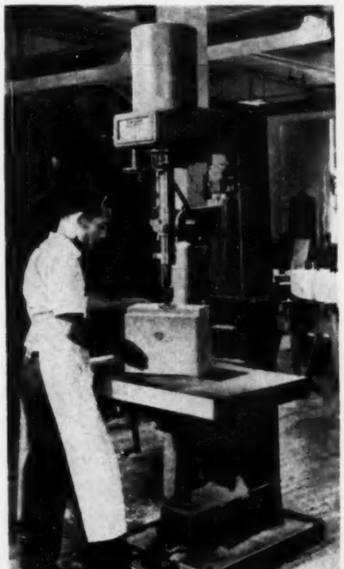
Circle Item 107 on postcard, page 189

Tube-Boring Machine

The Davis and Thompson Co., Milwaukee, Wis., has brought out a two-station, tube-boring machine with a capacity range from 4 1/4 inches through 9 inches in diameter, and from 18 through 48 inches in length.

Spindle speeds from 68 to 510 rpm are obtained through the use of change gears. The hydraulically controlled table has traverse speeds ranging from 0 to 10 inches per minute and a rapid advance speed of 250 feet per minute.

Equalizing-jaw fixtures have

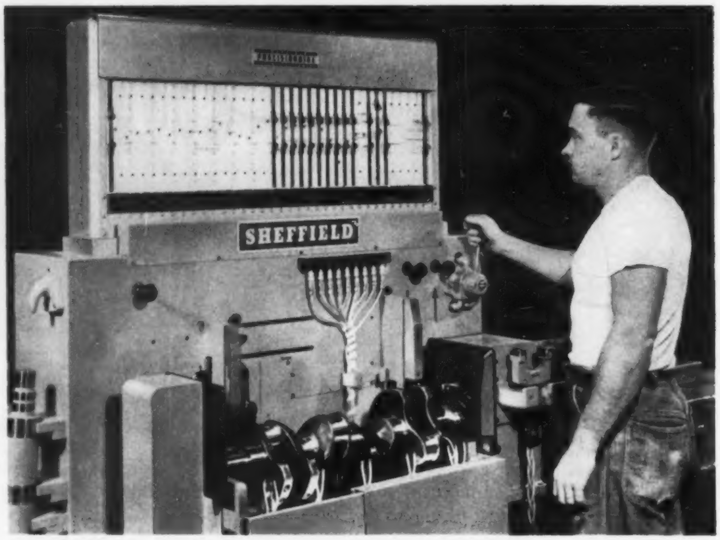


Leland-Gifford precision drilling machine for pattern shop use

hardened and ground slides moving on anti-friction linear bearings. Clamping is automatic and is controlled by Keller air-motors through a clamping screw. At the end of the automatic cycle the spindles are positioned to permit the withdrawal of tools from the work-piece.

Circle Item 108 on postcard, page 189

Gage for Measuring Diesel-Engine Crankshafts



Sheffield Precisionaire gage for measuring diesel-engine crankshafts

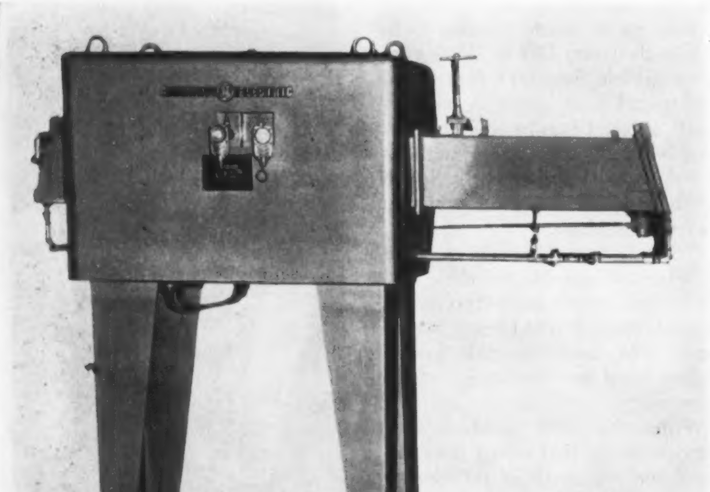
A multiple-dimension Precisionaire gage, designed by the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation, enables the operator to inspect three different sizes of diesel-engine crankshafts. Each crankshaft has as many as 47 dimensions and conditions that are checked in the gaging cycle. Previous gages were limited to the inspection of only one size.

Two sets of interchangeable, adjustable plate type tooling, together with hand type Airsnaps accommodate the three crankshaft sizes. Acceptable dimensions or amount of oversize or undersize are instantly shown during gaging by the position of the floats in the 34-column instrument. As long as the floats are within the minimum and maximum tolerance lines inscribed on the plastic Airechart running across the face of the instrument the part is acceptable. However, if a float or floats assume positions above or below the tolerance lines, part is rejected.

Circle Item 109 on postcard, page 189

General Electric Furnace with Cooling Chamber

A laboratory type box furnace developed to meet precise requirements for extremely high, automatically controlled temperatures in a protective atmosphere has been introduced by the General Electric Co., Schenectady, N. Y. This double-end, through type furnace is designed for copper and silver brazing of metals, metallic oxide reduction, melting metals, powdered-metal sintering and bright annealing of metals. Built by the company's Industrial Heating Department, Shelbyville, Ind., the new unit permits materials to be cooled in a protective atmosphere. Precision, automatic temperature control is by radiation detector. General Electric's Reactrol system is employed to provide stepless power control.



Laboratory type box furnace made by General Electric

It is claimed that only the power required by the process is consumed. Cast-iron doors on both heating and cooling chambers are equipped with manually operated flame curtains designed to prevent loss of atmosphere when the doors are open. A cooling chamber permits materials to be cooled in the protective atmosphere, thereby preventing oxidation of the charge.

The heating chamber, lined with high-purity brick suitable for operation up to 3200 F., is designed with throats at both ends to permit slow heating and cooling of the charge. A manually operated sliding door separates the cooling and heating chambers.

Circle Item 110 on postcard, page 189

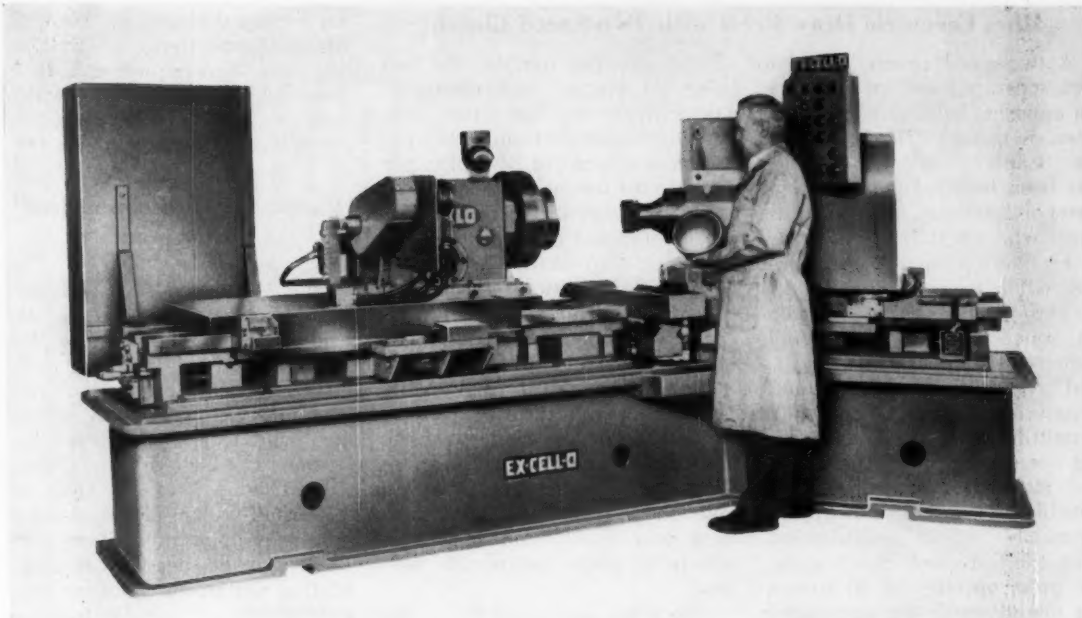


Fig. 1. Special machine built by the Ex-Cell-O Corporation for turning hemispherical aluminum forgings

Special Machine Developed for Turning Aluminum Hemispheres

A special turning machine, equipped to perform rough- and finish-machining operations on the outside and inside diameters of wrought or forged annealed aluminum hemispheres, has been built by the Ex-Cell-O Corporation, Detroit, Mich. This equipment will machine hemispheres ranging from 6 to 16 inches in diameter. A special work-spindle, designed for extreme accuracy and rigidity, permits the machine to hog out material at the rate of 15 cubic inches per minute at a cutting depth of 1/8 inch. A tolerance of less than 0.0001 inch on the hemisphere radii and approximately 0.0001 inch total on wall thickness are maintained on the finish cuts. A surface finish of 10 micro-inches is obtained.

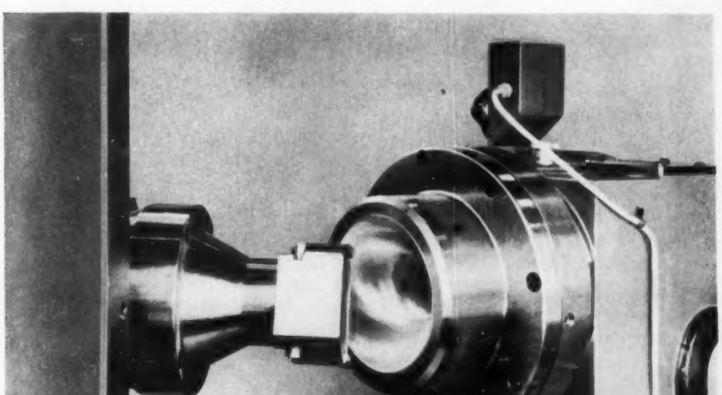


Fig. 2. Close-up of cutter-head of machine shown in Fig. 1 and part mounted in vacuum chuck

In operation the slide carrying the work-spindle is advanced to an end stop where it is locked in position. The accuracy of this slide motion is maintained within 0.0001 inch. A dial gage affords visual checking of this function by the operator. The cutter-spindle plunge-feeds to depth against another end stop having similar repeatability accuracy, which is also checked by a gage. While the cutter-spindle revolves at the required surface speed, the work-spindle makes slightly more than one complete revolution so that the tooling generates a complete hemisphere.

At the conclusion of the cutting cycle, the cutter-spindle retracts so that it will clear the part before the work-spindle retracts ready for unloading. This equipment is built to JIC standards. Electrical interlocking effectively safeguards both machine and operator during the production cycle.

Circle Item 111 on postcard, page 189

Bliss Eccentric Draw Press with Two-Speed Clutch

A two-speed clutch, split into two separate parts for mounting on opposing sides of a press, has been designed by the E. W. Bliss Co., Canton, Ohio. This clutch has been installed on a standard two-point, 600-ton, eccentric draw press which will be used by the A. O. Smith Corporation to form automobile rear-suspension brackets at the rate of 448 double pieces an hour. The two-speed clutch permits three operational speeds and takes advantage of maximum approach and return speeds, while permitting slow speeds for drawing operations. Speeds of 10, 16, and 20 strokes per minute are possible by using the clutch units separately or in combination. With the fast-speed clutch alone, the press operates at 20 strokes per minute; with the slow-speed clutch, at 10 strokes per minute.

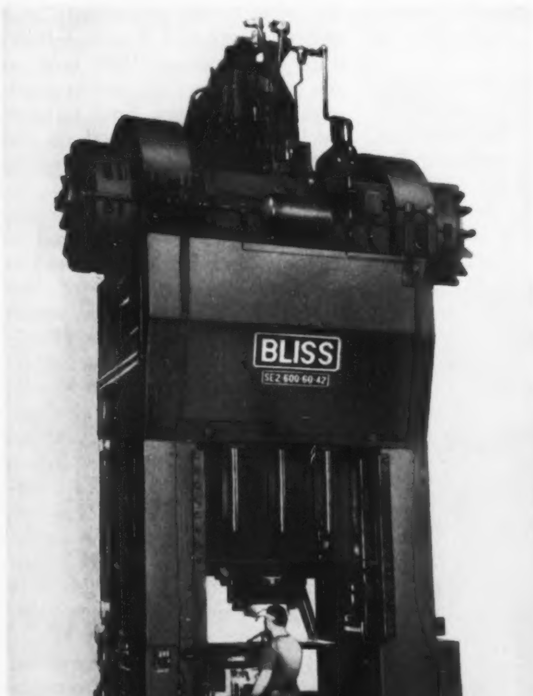
When the press is set to run at 16 strokes per minute, the two clutches engage and disengage successively so that the slide moves downward from its top position at a speed of 20 strokes per minute for one-half the length of the downward stroke, or a 90-degree rotational movement of the eccentric drive-shaft. Then, at the mid-stroke position, the slow-speed clutch takes over and the part is drawn at a speed of 10 strokes per minute for the remaining downward movement. The slide then returns to the top-stroke position at a speed of 20 strokes per minute. By using the 16 stroke per minute setting, production is increased by 60 per cent over that obtained with a steady 10 stroke per minute setting.

The press has a bed 60 by 42 inches. It is equipped with an automatic unloader and dual pedestal buttons designed by the A. O. Smith Corporation, as well as standard Bliss equipment. It is powered by a 75-hp motor which runs at a speed of 1200 rpm.

Circle Item 112 on postcard, page 189

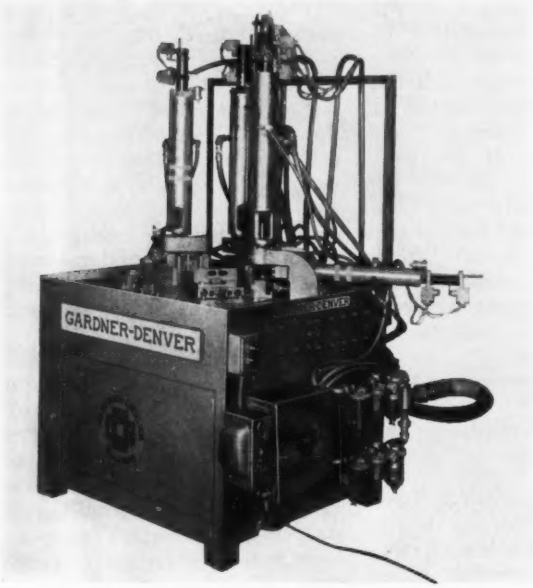
Wendt-Sonis "Econogrind" Equipment

The Wendt-Sonis Co., Hannibal, Mo., has announced the development of a grinding aid, called "Econogrind," designed specifically for use in connection with new and existing grinding equipment and techniques. According to the manufacturer, the principal advantages to the user of this liquid-cooled, electrical-assist process is its relatively low cost. This is made possible because existing equipment is utilized and little additional operator training is required. Diamond wheels, coolant, transformers, and other



Bliss 600-ton press equipped with two-speed clutch

"Econogrind" diamond-wheel grinding machine



Gardner-Denver dial indexing machine for processing track links

Air-O-Limit clearance comparator announced by the Pratt & Whitney Co., Inc.

auxiliary equipment are readily available if needed to complete the conversion of present equipment to the new process.

This process is claimed to greatly reduce diamond-wheel consumption, produce good finishes (6 to 8 micro-inches) with less grinding pressure. Because it is a cold, low-voltage process, it minimizes grinding cracks.

Actual savings made possible by the new method were shown in one application by the following tests: During normal and increased production grinding of semi-standard, single-point tools on a tool and cutter grinder using a D 180 N 100 B 1/8, 6-inch diameter diamond wheel with a 3/8-inch face, the wheel lasted 144 hours. Doing the same work on the same machine using a D 120 N 100 M 1/8, 6-inch diameter diamond wheel employing the new "Econogrind" process, the wheel lasted 1360 hours, or 10 times longer than a wheel operated in the ordinary manner. Also, approximately 10 per cent more tools were ground per hour with the new method. Surface finish on the carbide was the same in both cases. The cost of the wheel used in the "Econogrind" process was only about 5 per cent greater.

Circle Item 113 on postcard, page 189

Machine for Drilling and Reaming Track Links

The Gardner-Denver Co., Quincy, Ill., has designed and built a dial indexing machine to drill and ream forged track links in a single operation. The unit consists of a 36-inch diameter precision dial indexing machine on which five 92-10S-2-2 1/2 "airfeedrills" and two Keller Tool 96-6S-12-3 1/2 "airfeedrills" are mounted. This drilling and reaming machine has six work stations, three of which are available for manual loading and unloading. Both right- and left-hand links can be drilled on the unit. The setup time is approximately 20 minutes.

Circle Item 114 on postcard, page 189

Pratt & Whitney Air-O-Limit Clearance Comparator

The checking of clearances between the inside and outside diameters of mating parts to millionths of an inch is possible with an Air-O-Limit 3-station, ID-OD clearance comparator introduced by the Pratt & Whitney Co., Inc., West Hartford, Conn.

This recently developed comparator is designed for checking precision mechanisms, such as servo valves, where clearances are kept to a few millionths of an inch. It is a combination of two standard Model G—or Super G—Air-O-Limit gaging units (one inside diameter and one outside diameter) plus a computing circuit arrangement developed to meet specific requirements.

In operation, the output of the inside and outside diameter units is fed into a multiple-function computing relay, and the clearance or interference between the two parts is read on the clearance indicator in the center of the gage. The action of the indicators is fast, and the dials are large, so that readings can be obtained quickly, clearly, and accurately by the operator.

If required, the clearance indicator may have double the magnification of the other two indicators. For example, the inside diameter and outside diameter indicators may each have a full scale of 0.0002 inch, while the clearance indicator has a full scale of 0.0001 inch—with each division equivalent to two millionths of an inch (80,000 × magnification). Standard Air-O-Limit gaging plugs and rings are used in both the inside diameter and the outside diameter measuring units.

Circle Item 115 on postcard, page 189

Barnesdril Kleenall Coolant Filters

The Barnes Drill Co., Rockford, Ill., has announced a line of Kleenall combination magnetic and fabric coolant filters, incorporating several significant design changes. These changes are said to improve the operation and life of the filter and make possible reduced maintenance costs. Emphasis has been placed on anti-wear features and ease of access and installation. Kleenall filters are available in standard sizes and capacities as formerly offered, and are also adapted to central-system installations.

Of primary importance is the increased clearance between the filter fabric and distributor. This provides increased capacity for handling heavy swarf loads, reducing maintenance, and extending the life of the drive mechanism. On the drum drive-shaft, a separate sun gear is provided for ease of adjustment or replacement without removing the drive-shaft. Two planetary gears are also provided in the gear train, improving drive operation by distributing the load and minimizing wear. Increased pitch diameter of these planetary gears also results in a larger clutch assembly which is easily serviced.

A new style of belt-support bracket is said to improve alignment, increase the life of the fabric conveyor belt and simplify the problem of fabric installation. In the forward part of the filter under the fabric conveyor belt the drip plate has been relocated to provide greater clearance and improve operation of the conveyor.

Two supports have been provided in the front and back of the filter at the base to provide lifting support during installation or moving. These supports are positioned to prevent damage to the conveyor belt and filter.

Circle Item 116 on postcard, page 189

Motorized Grinding Spindles

The Standard Electrical Tool Co., Cincinnati, Ohio, has developed an entirely new line of motorized grinding spindles. Here illustrated are the smallest and the largest spindles in the line, including sizes ranging from a 1/2-hp unit for a 6-inch diameter grinding wheel to the 20-hp size for 24-inch diameter wheels.

The assembled motorized spindle unit consists of a heavy-ribbed combination base that supports the motor and the integral angular-positioned dovetail slide. The precision grinding spindle assembly has a bracket housing with integral dovetail to accomplish the required vertical spindle adjustment without raising or lowering the entire machine.

The ratio on the belt drive is computed to deliver the correct peripheral speed on intermediate-diameter wheels and permits further speed change, either through change-pulleys or original equipment with step-pulley range. The spindle is available with tapered nose to accommodate the independent assembly of wheel holder with grinding wheel. The wheel holder has balancing weights for use in fine precision grinding work.

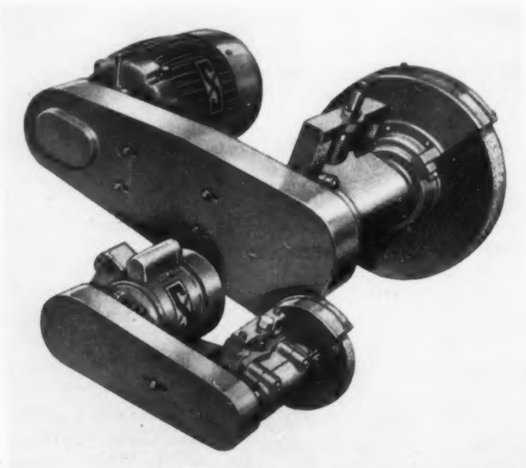
On the small- and medium-size units, the spindle bracket permits interchanging of the external grinding spindle with a variety of sizes of deep-hole grinding spindles. The units are also adaptable for a variety of roll-grinding operations on a lathe.

Circle Item 117 on postcard, page 189

Truarc Retaining Rings

A radially installed reinforced E-ring, said to provide approximately five times greater gripping strength and permit 50 per cent higher speed limits than conventional E-type fasteners, has been developed by Waldes Kohinoor, Inc., Long Island City, N. Y. This retaining ring, Fig. 1, known as the Waldes "Truarc Series 5144," is designed for use in the automotive, aeronautical, electronics, electrical appliance, and other industries in applications where extra holding power is required.

Kleenall combination magnetic and fabric coolant filter announced by Barnes Drill Co.



Motorized grinding spindles developed by the Standard Electrical Tool Co.

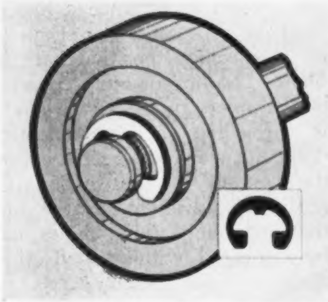


Fig. 1. Waldes Truarc reinforced type E-ring used to secure small wheel on its shaft

The Series 5144 rings made of aluminum, beryllium copper, and stainless steel have more gripping power than comparable size E-rings made of carbon spring steel. They are manufactured in sizes to accommodate shafts ranging in diameter from 3/32 to 7/16 inch. Ring dimensions permit substitution for conventional E-rings in most applications.

The Series 5115 axially installed self-locking retaining ring, Fig. 2, which provides approximately twice the thrust-load capacity of conventional type push-on fasteners and can accommodate shaft tolerances up to ± 0.005 inch, is another recently introduced Waldes Kohinoor product. This ring has a reinforced, arched rim which provides unusual strength and resistance to bending, twisting, and buckling. Extra-long locking prongs made it possible for the fastener to accommodate shaft tolerances ranging from ± 0.003 inch for the smallest size ring to ± 0.005 inch for the larger sizes.

Because of its wide tolerance range, the fastener may be used on tubes, cast parts, and plastic shafts and studs. It is particularly

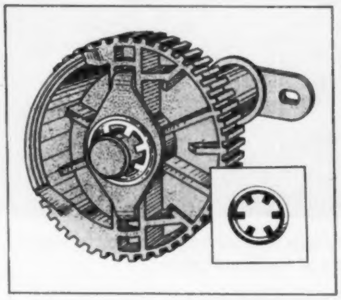


Fig. 2. Waldes Truarc self-locking retaining ring used on nylon windshield wiper gear

effective on irregularly shaped parts where dimensional variations often prohibit the use of conventional push-on fasteners. Since no groove is required, the ring may be installed at any point on the shaft, automatically compensating for manufacturing tolerances in the parts being secured. It is manufactured in fourteen sizes to accommodate shafts ranging in nominal diameter from 3/32 to 1.0 inch. In the smaller sizes, the rings are produced in three metal thicknesses: 0.010, 0.012 and 0.015 inch.

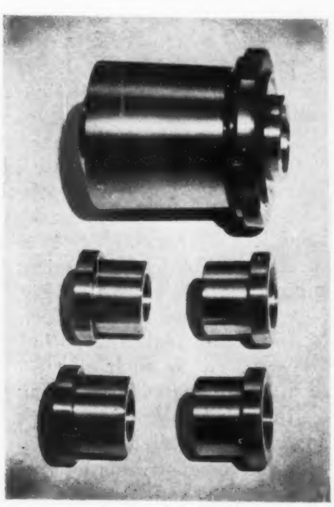
Circle Item 118 on postcard, page 189

Sonnet Roller-Bearing Outboard Support for Milling Machine Arbors

The Sonnet Tool & Mfg. Co., Hawthorne, Calif., has brought out a roller-bearing outboard support for milling machine arbors which can be easily installed in place of the taper bronze bearings regularly supplied. Among the advantages claimed for this anti-friction bearing over the bronze bearing are: higher permissible speeds and feeds; better finish obtained on work; and elimination of cutter chatter. Longer cutter life is also said to be obtained when the roller-bearing outboard support is used. In one case an increase from 200 to 700 pieces per cutter sharpening was obtained.

The roller bearing, upper view Fig. 1, can be provided with bushings like the two sets shown in the lower views to accommodate milling arbors or spindles of different sizes. Design of the roller bearing with two rows of bearings, seals, and lock-nut, as shown in Fig. 2, has been developed to facilitate installation and to give trouble-free operation.

Circle Item 119 on postcard, page 189



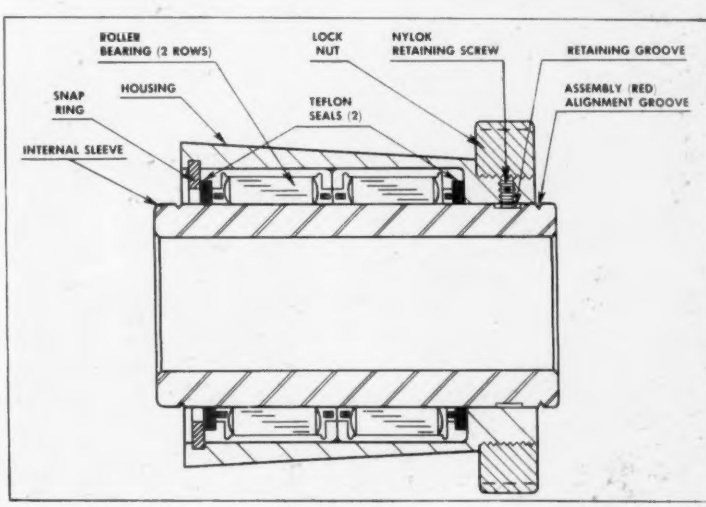


Fig. 1. (Left) Sonnet roller-bearing outboard support and adapter bushings for milling machine. Fig. 2. Cross-section of roller bearing shown in Fig. 1

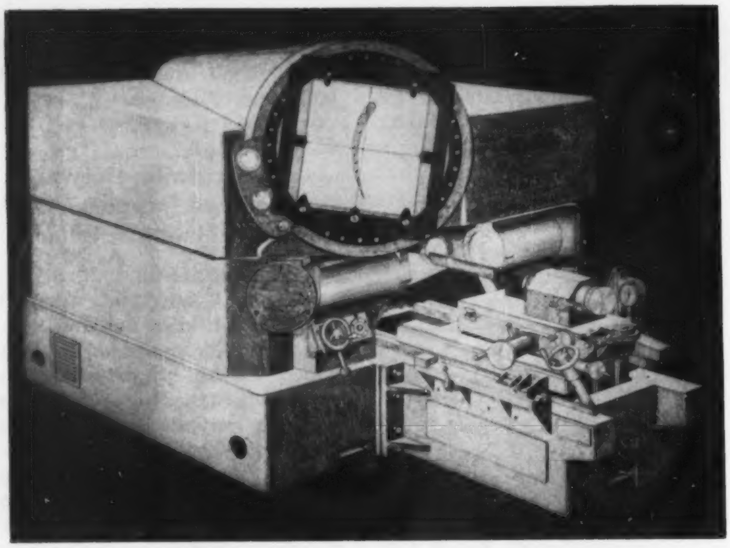


Fig. 1. Section-profile projector developed by Eastman Kodak Co. for rapid, accurate mass inspection of turbine blades

Kodak Section-Profile Projector for Turbine-Engine Blades

An optical projector that uses two beams of light to solve the difficult problem of inspecting turbine-engine blades has been developed by the Eastman Kodak Co.'s Apparatus and Optical Division, Rochester, N. Y. This precision instrument, Fig. 1, is known as the "Kodak Section-Profile Projector." Briefly, the projector design is based on the idea of illuminating an air-foil section to produce a line of light—as represented in Fig. 2—at a specified position on the blade. The line of light, covering the complete profile of the blade, is projected at magnification upon the viewing screen to show the contour of the section. Of particular advantage is the fact that extremely thin blades can be inspected without deflection, since a light beam exerts no pressure on the part.

While this idea is not novel, its application in this instance has been accomplished by a new engineering approach. The design permits the viewing of an entire section of a compressor blade, vane, turbine bucket, or half of a forging die on the 30-inch diameter screen. With some training, an operator can rapidly measure dimensions of such parts to an accuracy of 0.0005 inch, as well as determine the twist to 5 minutes of arc.

Although the projector will be used primarily for inspecting the blades of jet engines, it is expected to have other uses. The optical system, Fig. 3, of the air-foil sectional projector has three major advantages for this type of inspection work: (1) It provides illumination for a well defined image; (2) permits long turbine blades to be inspected; and (3) the instrument can project entire sections of shrouded blades or blades which have a high twist. It will be noted that identical optical systems are used on both sides of the blade, the entire profile of a section being projected by matching the half-profiles from each system.

Two high-pressure, mercury-vapor lamps provide intense illumination on both sides of the blade. A special contour mask and relay lens system combine to eliminate distortion in the illuminating optical system, shown in Fig. 3. The bright line of light focused on the blade, as illustrated in Fig. 2, is viewed by each of the two lens systems at a 35-degree angle to the blade. Viewing at these angles prevents interference of the light beam by blade shrouding or twist and permits the inspection of long blades. A mirror system and a Fresnel bi-prism re-

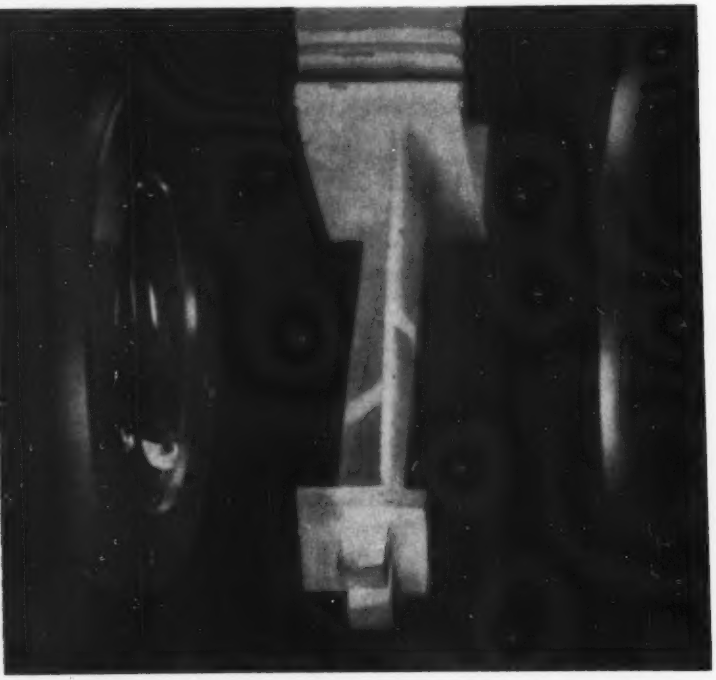


Fig. 2. View showing line of light that covers completely the profile of a blade to be projected on screen

direct the images of each side of the blade so that they correctly enter the projection lens to give one complete image.

The blade-section contour appears on the screen of the projector as a dark image sharply outlined by a bright band of light. Both leading and trailing edges are shown with equal clarity for inspection. The projector will inspect work up to 16 inches in length, with 2 1/4 inches chord and 45 or more degrees of twist. Standard airfoil charts or specifications can be used as overlays on the projector screen, as indicated in Fig. 1, to determine directly whether the turbine blade is within the established tolerances.

To permit measurement of out-of-tolerance conditions in blade thickness or chordal length, the work-table can be moved both vertically and horizontally on precision ways. Likewise, angular measurements of deviations in twist angle of the airfoil section relative to the blade root can be measured by rotation of an index-head. All of these measurements are read instantly on large dial indicators. The entire work-table assembly is carried on a retractable carriage which permits positioning any desired airfoil section along the blade length. This carriage is provided with a vernier scale reading directly in thousandths of an inch and also with solid stop-blocks between which measuring rods can be inserted for rapidity in locating airfoil sections on repetitive inspections.

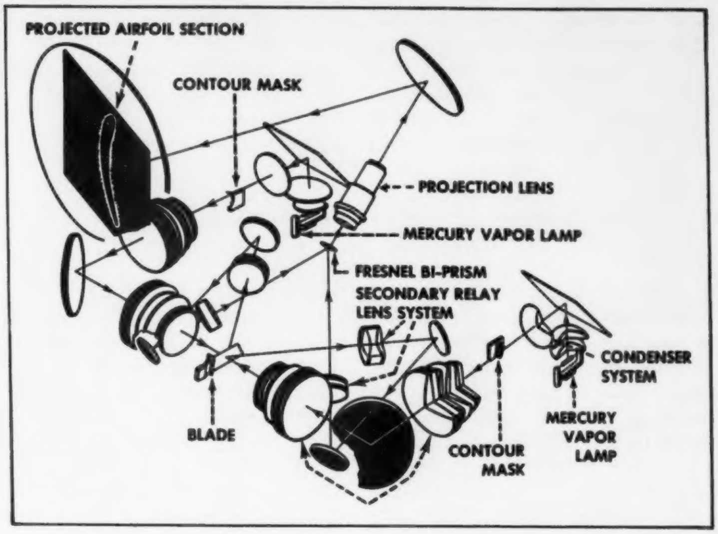
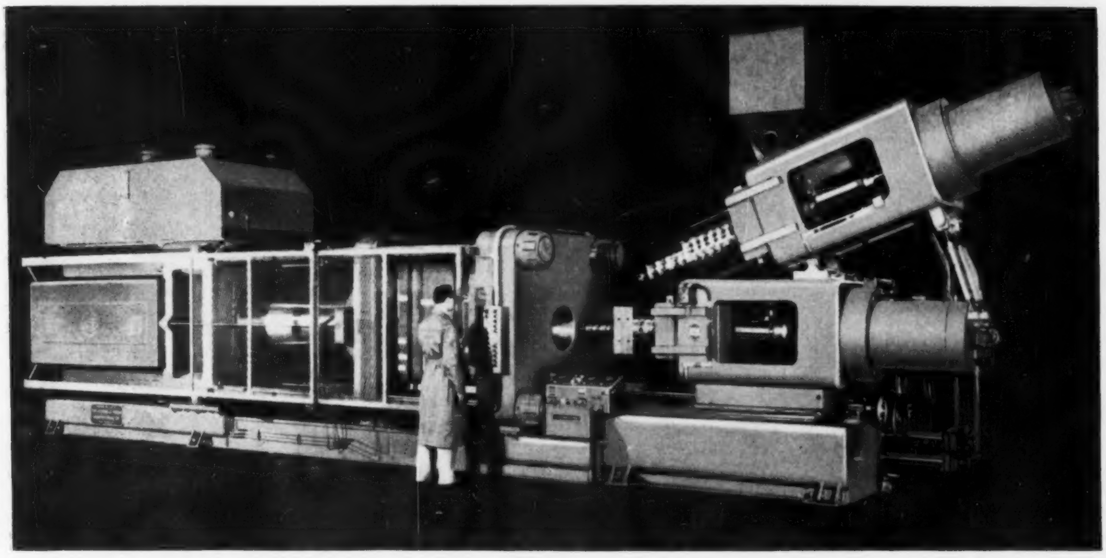


Fig. 3. Primary relay lens system of Kodak section-profile projector

Circle Item 120 on postcard, page 189

Injection Molding Machine for Large Plastic Parts

A preplasticizing injection molding machine of 300-ounce capacity, designed for the production of large plastic parts, is announced by the Hydraulic Press Mfg. Co., A Division of Koehring Co., Mount Gilead, Ohio. This 1500-ton unit has an injection rate of 6640 cubic inches of material per minute. The mold-mounting area is 48 by 72 inches. The hydraulic mold clamp has a stroke of 60 inches. A daylight capacity of 106 inches makes this H-P-M Model 1500-P-300 molding machine especially well suited for the production of deep parts such as clothes hampers, laundry bas-



H-P-M preplasticizing injection molding machine developed for production of large plastic parts

kets, trash cans, large industrial containers, and television parts.

The combined operations of a new type three-way, rotary material control valve and an adjustable stop nut incorporated in this machine are said to make possible exceptionally high-speed production of quality, minimum weight parts with absolute control over "shot" weight.

Circle Item 121 on postcard, page 189

Van Norman Centerless Grinder for Processing Universal Joint Crosses

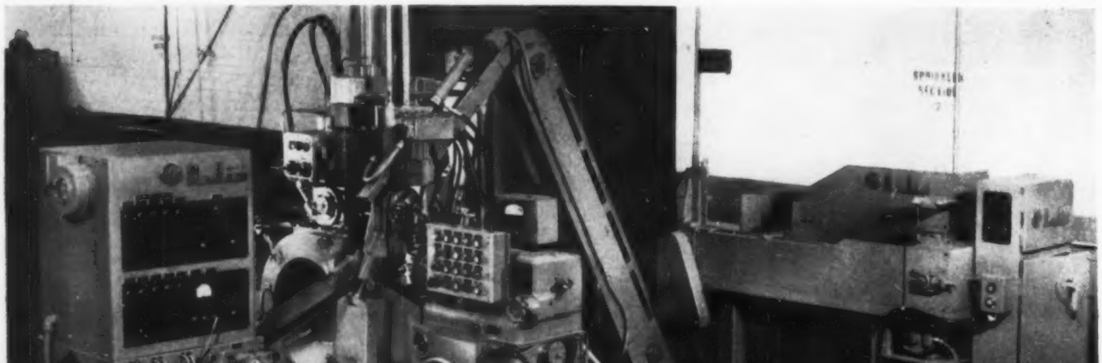
The Van Norman Machine Co., Springfield, Mass., has developed a machine which automatically finishes the four arms on universal joint crosses by centerless grinding at the rate of 250 pieces per hour. This production rate exceeds that of machines previously used by 150 to 180 pieces per hour. The automatic cycle consists of loading, orienting, grinding, and gaging the part. It also includes holding the work to the required tolerances. Two of these machines have been built for the Chrysler Corporation.

This unit is completely automatic, utilizing a non-mar, belt type conveyor. The conveyor deposits the parts, properly oriented, on an elevator which lifts them above the loading and indexing fixture in the machine.

The loading cycle is timed to present the parts to the loading and indexing fixture of the machine at the proper instant to prevent jamming and overflow of parts. When a part is replaced in the drum type fixture, the drum rotates, depositing the part on a set of fingers or hooks. The part is then lowered by an elevator to the work-rest blade of the centerless grinder. When the elevator fixture reaches its lowest point, a micro switch is energized, causing the regulating wheel-slide to move forward in rapid advance and then automatically begin a grinding-feed and spark-out cycle. At the end of the spark-out time the wheel-slide is automatically retracted and the part elevated to its original starting position.

At this point a micro switch is contacted, causing the drum fixture to rotate 90 degrees automatically orienting the part in the required 90-degree position. Another part is then dropped into its starting position so that there are two parts in the drum. The elevator fixture is again energized and lowered to the work-rest blade. This brings two parts to the blade—the first part already ground on two journals, and the new unground part. The machine again goes through its grinding, spark-out, and retraction cycle. In this cycle the remaining two opposed journals or arms of the first part are finished. The elevator is again automatically raised to its extreme "up" position. The parts are again deposited in the rotating drum which turns 90 degrees as before.

During this cycle, the part that was first introduced to the drum, having been finish-ground, is ejected into a chute which deposits it in the automatic gage. The second part has now been indexed to the No. 2 position and

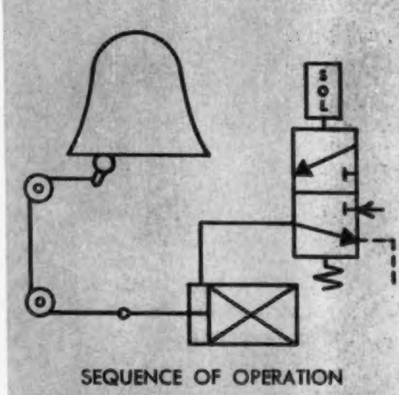


Centerless grinding machine built by the Van Norman Machine Co. for automatically processing universal joint differential crosses

What? Air Power Rings the Bells!

Air powered clappers for the bell tower may be strictly fiction, but . . .

Can you imagine a keyboard that's a set of electrical switches. They operate a set of solenoid valves which in turn advance and retract cylinders. The cylinders, of course, pull the clapper cords. Shows that anything can happen when an air-minded engineer gets in the spirit of the season. But while this is just a flight of the imagination that you aren't likely to see installed in a carillon soon, you might very well want to take advantage of the underlying idea in some of your *plant operations*. Here is the idea:



SEQUENCE OF OPERATION
Every time solenoid is energized, bell clapper is pulled against bell.

Just one operator can control hundreds of operations by using solenoid valves.

And these solenoid valves, you'll notice, are manifolded. The manifolding saves piping, space, etc., just as has been possible for years with Ross valves that are operated manually, by air, cams, etc. Incidentally, you won't find this manifold in our catalog . . . it is one of the many refinements and variations of the standard Ross line that make it so flexible. To keep fully aware of the developments continually being made to increase the flexibility of the Ross line, keep in close touch with your local Ross Valve Engineer.

ROSS OPERATING VALVE CO. 110 East Golden Gate • Detroit 3, Michigan

For more data on any products advertised this issue use card, page 189

a new part introduced to the first position. This cycle is then repeated as described. The part deposited in the gaging mechanism contacts a micro switch that energizes a horizontal slide. The latter moves the part on to a set of rotated V-blocks. When the part is in position in the gage the probe is automatically lowered over one journal. The probe instantly measures the part, and indicating lights in the gaging panel record the size of each journal.

The panel has a series of ten lights in sets of five and the bottom row shows the reading recorded by the probe during each measuring operation. The upper set of lights stores this information. The final results after making four measurements are shown by the upper row.

If the approach high-limit light is lit more than three times during one measuring cycle, the machine will automatically bring the next part to the required mean dimension. If the approach low-limit green light is lit more than three times, the machine will stop, indicating that the wheel must be retracted 0.0001 or 0.0002 inch to bring the part to the mean dimension. If, at any time, the under-size amber light or the over-size red light is lit, the machine will automatically stop.

Wheel dressing is accomplished by the crush method which forms the outside diameter as well as an adjacent radius. Twelve hundred pieces are finished per wheel dressing. A finish of 15 microinches or better is obtained.

Circle Item 122 on postcard, page 189

Thule Vertical Shaper

The Austin Industrial Corporation, White Plains, N. Y., is introducing a Thule Model ST-12-inch vertical shaper which is said to eliminate complicated tooling and save time through its ability to machine, at one setup, parts having regular or irregular, internal or external contours. Meehanite castings are used throughout this heavy-duty machine. The column and base are cast integral to assure rigidity and eliminate vibration. Six ram speeds are available, ranging from 15 to 75 strokes per minute.

Work-saving features include: fast ram return at twice the cutting speed; ram brake; longitudinal, transverse and rotary movements by hand feed and power feed; power rapid traverse in three directions; and ram that swivels 12 degrees vertically.

Standard equipment includes 24-inch diameter built-in rotary table arranged for both crank indexing and direct indexing, automatic pressure lubrication, and V-belt drive from 5-hp motor.

Circle Item 123 on postcard, page 189

Covel Optical Comparator

The Covel Mfg. Co., Benton Harbor, Mich., has announced a No. 14 optical comparator arranged with a special fixture in place of the standard staging unit. This equipment is designed for checking the fillets in the five main bearings of a crankshaft, as well as the fillets in the crank pins.

The work-holding fixture is mounted on a supporting table and is moved from right to left on ways or tracks through a rack and pinion. Halation, which in the past has always been a problem in optical inspection work of this nature, was overcome by deviating slightly from the regular optical system.

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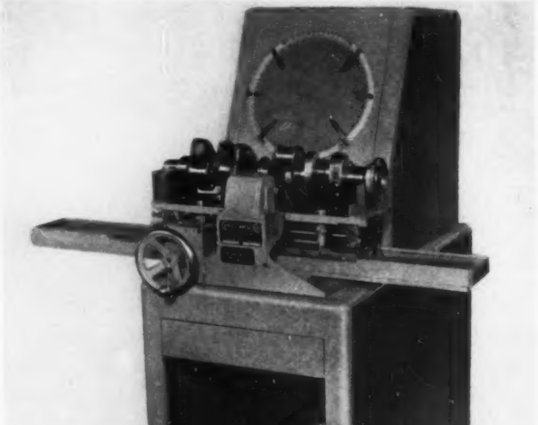
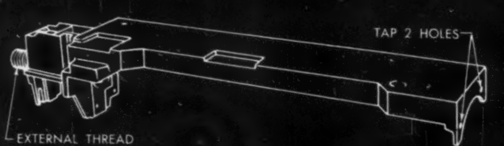
(*This section continued on page 186*)

Thule shaper introduced by Austin Industrial Corporation

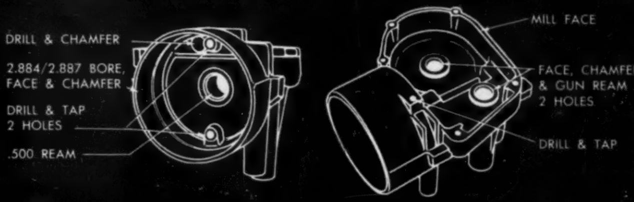


Optical comparator announced by the Covel Mfg. Co.

Ready to produce and produce and produce



SPEEDOMETER FRAME



WINDSHIELD WIPER HOUSING

These two machines are shown on our assembly floor ready to ship. One is a simple double-end machine with no indexing, the other a large center-column machine with indexing.

Both machines operate on die castings at high production rates. Both have power clamping and unclamping. Each operator removes a finished part, puts a new one in the fixture and presses buttons to clamp it.

The customers approved test runs here on our assembly floor. They continue to get good production because of good basic design and rugged, accurate construction.

Speedometer Frame 600 parts per hour is the gross production on the double-end machine (left). The left unit threads a stem with a self-opening die head while the right unit taps two holes. Another Kingsbury (not shown) operates on 11 holes in the same part.

Windshield Wiper Housing 460 parts per hour is the gross production on the big 13-spindle machine. A 43-inch index table holds seven work fixtures. The face to be milled is on top.

The first unit at the man's left mills the face at 3500 rpm. It is 30° right of the radial centerline through the station. For the holes in the center sketch there are four horizontal units, each 60° left of the radial centerlines.

Four vertical units operate on holes in the right sketch. A combination tool machines the .500 hole and 2.884 bore concentric within .003 T.I.R.

Special features include —
— Filtered coolant for all tools and gun reaming of two holes for a high finish.
— Oil mist lubrication for the multi-spindle auxiliary heads.
— Lights that identify any unit that fails to complete its cycle.

Little downtime, few rejects Our customers tell us that their Kingsburys run month after month without trouble. A Kingsbury can do the same for you. Kingsbury Machine Tool Corp., Keene, New Hampshire.

KINGSBURY

MULTI-UNIT AUTOMATICS

Precision surface grinder developed by DoALL Co.

Sheffield bench model ultrasonic machine tool

Do-ALL Precision Hand Surface Grinder

A Model DH-612 precision hand surface grinder, designed to feature operator convenience, is a recent addition to the line of metalworking machines manufactured by the DoALL Co., Des Plaines, Ill. In this equipment, precision and accuracy have been combined with features developed to facilitate operation.

The 6-inch adjustment permits the operator to select the best height for either the standing or sitting position. The down-feed handwheel, located 12 inches from the column, is at eye level, eliminating stretching and straining. At the same time the handwheel is kept out of the way where there is little danger of its being accidently bumped or turned. Each revolution of the handwheel equals a feed of 0.025 inch. This provides wide calibrations so that grinding to a "split tenth" is accomplished without eyestrain. The cross-feed handwheel also has wide spacing of the 0.0005-inch graduations. The table-feed handwheel can be located on either side of the saddle for convenient right- or left-hand operation. The table feed is accomplished by means of a smooth timing-belt drive that permits lag-free reversal.

The 1-hp motorized spindle is similar to those used on larger DoALL grinders. All way surfaces and feed-screws are lubricated by a positive one-shot system. Bearing surfaces are precision ground and completely dust-sealed by metal guards. The saddle has a convenient tool tray. A saddle lock is provided for plunge- or form-grinding.

Optional features include a versatile coolant system that permits the use of both flood coolant and DoALL's through-the-wheel "Cool Grinding." The hydraulic table-feed attachment can be installed with its control mounted on the work tray. This permits separate speed control for each direction.

A complete line of attachments and accessories similar to those supplied with larger DoALL surface grinders are available. These include electro-magnetic chucks, permanent magnet chucks, sine chucks, radius dressers, wheel balancer, dust collector, guard-mounted wheel dressers, and modifications for electrolytic grinding.

Circle Item 125 on postcard, page 189

Ultrasonic Machine Tool

A compact, bench model, ultrasonic machine tool designed especially for use in cramped quarters has been developed by the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. Designated the Sheffield-Cavitron Model No. 200-B2 ultrasonic machine tool, it requires a bench space less than 2 by 4 feet, yet is capable of handling production as well as experimental machining of hard, brittle materials with accuracy and economy.

This machine has an effective machining area ranging from 1/64 to 1 inch in materials such as germanium, silicon, ferrite, hardened steel, and carbide. It will also perform typical ultrasonic machining operations such as cutting, drilling, engraving, slicing, and dicing. Complex shapes and forms can also be produced. On special applications, materials similar to soft steel can be machined.

The unit utilizes a magnetostrictive transducer to provide up to 25,000 machining strokes per second. The transducer is powered by a 110-volt, 60-cycle, alternating-current, electronic generator

supplying 250 watts output. An automatic tuning device in the generator senses and compensates for tool wear. A signal light built into the unit constantly monitors progress of the tool into the work-piece. Vertical tool adjustment is 2 inches. The tool is fed into the work-piece by manual control or by means of an infinitely adjustable gravity control, and tool travel is visually indicated by a dial. The tool is radially adjustable through 360 degrees. An 8-inch work chuck is mounted on the table which is adjustable on 8-inch longitudinal and 6-inch cross-slides by hand-wheels having 0.001-inch graduations. The electronic generator measures 16 by 14 by 11 inches high. The machine unit is 20 by 20 by 31 inches high.

Circle Item 126 on postcard, page 189

Manipulator for Fully Automatic Welding Head

The Pandjiris Weldment Co., St. Louis, Mo., now offers the "Piper" series welding-head manipulator, along with the SAM, SWHM, and RBM series. The "Piper" series is a new economy model designed to manipulate a fully automatic welding head, and is available in two standard sizes. Model 606 has a 6-foot vertical arc height, and a 6-foot horizontal boom travel, while the Model 808 has an 8-foot vertical arc height, and an 8-foot horizontal boom travel.

Powerized elevation with brake motor, constant speed, push-button control and 360-degree manual column rotation are standard features on all models. Either model is available with stationary base, manual or powerized variable-speed boom, and car travel. The welding power source is carried on a travel car, which operates on 36-inch gage track. Variable-speed drive for boom and car is 0 to 120 inches per minute, or in a 20 to 1 ratio speed range. The illustration shows the Model 606 "Piper" manipulator.

Circle Item 127 on postcard, page 189

Magnetic Non-Destructive Inspection Equipment

Multiple-frequency equipment for high-speed, non-destructive inspection of both non-ferrous and non-magnetic metals is now available from the Magnetic Analysis Corporation, Long Island City, N. Y. This equipment, based on the use of an advanced and highly versatile eddy-current inspection system, was shown for the first time at the National Metal Exposition in Cleveland. It is especially adapted for production line or independent testing of tubing, bars, and wire for surface and subsurface defects.

Typical metals tested include aluminum, titanium, zirconium, copper, copper-nickel alloys, brass and similar alloys, high-temperature alloys, and austenitic stainless steels. Inspection speeds range from 200 to 600 feet per minute. Coils are available for testing material from 1/8 inch to 3 inches in diameter.

This equipment utilizes two frequencies, operating simultaneously—with two flaw-detection circuits and one property-variation detection circuit for each frequency. This dual-frequency operation, with a total of six inspection methods, permits simultaneous detection of a wide variety of flaws.

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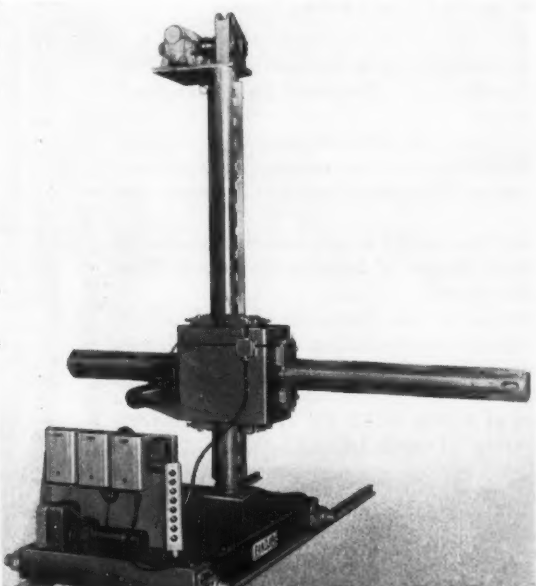
(*This section continued on page 194*)



"Piper" series manipulator for automatic welding head announced by Pandjiris Weldment Co.

Non-destructive inspection equipment introduced by the Magnetic Analysis Corporation

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

WELDER'S MANUAL—Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill. Booklet presenting instructional information designed to train and qualify individuals in welding aluminum by the inert-gas process. In the first section essential factors about both tungsten-inert-gas and metal-inert-gas welding techniques are presented. The second and third sections of the manual offer step-by-step exercises amply illustrated. Copy of the booklet may be obtained free when requested upon company letterhead. A charge of $1.00 per copy is made when the booklet is requested for personal reference use. Address all requests to Technical Publications Department, Kaiser Aluminum & Chemical Sales, Inc., 919 N. Michigan Ave., Chicago 11, Ill.

ROLLER BEARINGS—The Torrington Co., Bantam Bearings Division, South Bend, Ind. Catalogue No. 258, covering five standard series of self-aligning spherical roller bearings, with bore sizes ranging from 40 mm up through 1060 mm. Given are complete dimension tables, load ratings expressed as basic dynamic capacity, and line graphs showing modifying speed and life factors. A copy of this catalogue may be obtained by writing on your letterhead to the Torrington Co., 3702 W. Sample St., Bantam Bearings Division, South Bend 21, Ind.

GENERAL PRODUCTS—Ex-Cell-O Corporation, Detroit, Mich. Catalogue listing the diverse products of the corporation, which include precision boring machines, custom and transfer machines, precision thread grinders, etc. The catalogue is available upon request on company letterhead. Write to Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit 32, Mich.

EPOXY RESINS—Rezolin, Inc., Santa Monica, Calif. Bulletin RPD900, introducing a new laminating epoxy resin, "Epolite 90," for tooling and equipment. The bulletin delineates the physical properties of Epolite 90 and illustrates typical applications of this low-toxic laminating resin, such as assembly fixtures, duplicate master surfaces and other tooling in the aircraft industry; duplicate master models and other plastic tooling in the automotive industry; and for foundry work, a 52-inch long three-part core box, highly resistant to impact and surface abrasion, made quickly and inexpensively. 1

DRILLING MACHINES—Edlund Machinery Co., Cortland, N. Y. Bulletin No. 160 R, illustrating cost-cutting features of two Edlund models, 1F high-speed sensitive drilling machine and 1F semi-automatic power feed, designed especially for use on the high-speed sensitive drill. Of air hydraulic type, the power feed lends itself to either automatic or semi-automatic operation control through an electrical push-button or a foot-switch. 2

HONING JOBS—Sunnen Products Co., St. Louis, Mo. Booklet giving production rates, size, tolerance, stock removal, and finish data on ninety-nine widely diversified parts from 1/8 inch to 2 3/4 inches inside diameter. Illustrated with photos of each part—from screw-machine work to castings—the problems shown cover many materials, and include parts with keyways, splines, and blind holes, indexed for quick reference. 3

CLEANING AGENTS—MacDermid, Inc., Waterbury, Conn. Two instruction sheets, presenting cleaning agents for various metals. Technical Data Sheet No. 77 describes an acid-base liquid, "Metex L-5," used to remove oxide and tarnish from copper, copper alloys, and silver. Technical Data Sheet No. 11 describes a

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dry, iron phosphating compound, "Metex Durafos No. 6," designed to clean and phosphate steel, aluminum, zinc, and cadmium in one operation. **4**

WELDING SUPPLIES—Air Reduction Sales Co., a Division of Air Reduction Co., Inc., New York City. Welding supplies and accessories catalogue (Form ADC 848C), illustrating with over one-hundred photographs Airco's complete line of fluxes, and ferrous and non-ferrous rods for gas welding; and accessory items including protective clothing, goggles, electrode holders, sparklighters, cable, hose, weld cleaning tools, cylinder trucks, and many other items, for both arc and gas welding. **5**

DRILL JIG BUSHINGS—Standard Bushing Manufacturers, Inc., Providence, R. I. Catalogue No. 582, describing their broad line of high-precision, drill jig bushings. Covered in detail are such features as the easy-entry blended radius, full-length no-counterbore bearing, honed or lapped bores, corrosion-proof external finish, and heat-treatment in carbon-balanced protective atmospheres. All parts are catalogued. **6**

DESIGN—Small Lot Stamping Institute, Minneapolis, Minn. Manual directed primarily to engineers and purchasing agents, offering suggestions in design specifications which are intended to help standardize short-run stamping requirements and thereby lower production costs. Included in the manual are suggestions about quantities, materials, tolerances, clearances, blank design, piercing, and bending. **7**

SLITTING EQUIPMENT—E. W. Bliss Co., Canton, Ohio. Bulletin 44-A, presenting a complete line of slitting equipment for coils and sheet stock. Also explained are recommended slitting procedures, including suggestions on coil handling, width of cut, and use of entry and delivery pinch rolls. Design features are described and illustrated, and capacities for standard slitters are listed in table form. **8**

MILLING MACHINES—Cincinnati Gilbert Machine Tool Co., Cincinnati, Ohio. Catalogue featuring new floor type horizontal boring, drilling, and milling machines with 4- and 5-inch spindles. Full pendent control, optional column heights, Tele-Vernier measuring system, auxiliary work-holding units, and accessories are among the features included. The catalogue contains complete specifications. **9**

MACHINE TOOLS—Boice-Crane Co., Toledo, Ohio. Catalogue No. 58, describing a line of machine tools. Full details are included on a line of band saws, contour saws and band filers, jig saws, saw jointers, saw tables, shapers and shaper cutters, drill presses, tool and knife grinders, jointers, lathes, planers, belt and spindle sanders, spinning tools, motors, controls, supplies, and accessories. **10**

CLEANING COSTS—E. I. Du Pont de Nemours & Co., Wilmington, Del. Two booklets presenting new methods for quickly analyzing and comparing metal cleaning costs. The first outlines possible economies resulting from the so-called "High-Spot" cost analysis, while the second booklet describes a more extensive cost analysis. **11**

VISES—Heinrich Tools, Inc., Racine, Wis. Two brochures, featuring holding devices. One describes a complete air-vise line for automatic, self-centering operations within a tolerance of 0.001 with holding power up to 4000 pounds at 100 psi. The second presents screwless vises. Complete specifications are given on ten models. **12**

TUBING—Superior Tube Co., Norristown, Pa. Data Memorandum No. 7, presenting small-diameter beryllium-copper tubing. It describes mechanical and physical properties, applications, corrosion resistance, production limits, heat-treatment, fabrication, and standard size tolerances of the tubing. **13**

STEEL TUBING—Ohio Seamless Tube Division of Copperweld Steel Co., Shelby, Ohio. General catalogue CS-59, describing seamless and resistance-welded steel tubing in mechanical, airframe, and pressure grades. It contains information on fabricated and forged steel tubing, special shapes, tolerances, and size ranges. **14**

NUT UNITS—Wales-Strippit, Inc., Akron, N. Y. Catalogue describing Strippit pierce nut units for staking Fabristeel nuts into sheet metal for assembly-panel production. Operation and specifications of the press-actuated Type "CD" and "BL" Units for short, medium, and long runs of nut insertions are fully covered. **15**

SPRAYED COATINGS—Metallizing Engineering Co., Inc., Westbury, N. Y. Bulletin 136A, giving basic data on wire and powder sprayed coatings of metals and ceramics. It covers their basic characteristics, including hardness, tensile, and bond strength of various coatings, plus a wide range of mechanical and electrical-electronic applications. **16**

DRILLING AND TAPPING MACHINES—Baker Brothers, Inc., Toledo, Ohio. Two catalogues providing data on the new line of Baker horizontal and vertical hydraulic drilling and tapping machines and units. Approximately twenty-seven different models of the fixed-center spindle heads are also available for these same basic units. **17**

FORGING DIES—E. W. Bliss Co., Mackintosh-Hemphill Division, Pittsburgh, Pa. Bulletin No. 56, presenting the com-

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pany's cast forging dies and auxiliaries. Described in the leaflet are Mack-Hemp cogging-hammer dies, cogging-press dies, sow blocks and anvil bases, with helpful suggestions on selecting the proper surface hardness and alloys. 18

AUTOMATIC FEEDER—Radio Corporation of America, Camden, N. J. Brochure (Form No. 3R3384), on automatic parts feeders. These include: non-mar feeder-orientors for handling fragile and highly finished parts, elevating oriented feed hoppers, stack feeders, etc. 19

COATING MACHINE — Hanson-Van Winkle-Munning Co., Matawan, N. J. Bulletin describing Convert-O-Matic, a full automatic, straight-line conversion coating machine. Also described are features of a processing barrel with a cover that opens and closes automatically to receive and discharge the work load. 20

POWER PRESS—Johnson Machine & Press Corp., Elkhart, Ind. Catalogue 1958-A, covering the company's line of flywheel and back-geared inclinable presses from 16 to 150 tons, single- and double-crank straight-side presses from 40 to 250 tons, etc. 21

HOLDING DEVICES—Heinrich Tools, Inc., Racine, Wis. Catalogue providing complete description as well as tool application problems and solutions of full line of screwless, fast-production vises, and automatic self-centering air vises. 22

CUTTING TOOLS—Metallurgical Products Department, General Electric Co., Detroit, Mich. Catalogue presenting information about Carboloy cemented-carbide cutting-tool materials. There also is a new technical and application data section on Carboloy cemented carbides. 23

TURRET DRILL—Burgmaster Corporation, Gardena, Calif. Folder telling how to reduce the cost of drilling small holes, as well as perform a half dozen different machining operations on the bench-model, Burgmaster turret drill. 24

TUBING—Superior Tube Co., Norristown, Pa. Bulletin No. 41, giving the form (seamless or Weldrawn), characteristics, and applications of sixty-three standard and twenty-six special materials cold-drawn by the company into small tubing 25

SCREW-THREAD SERVICE — Standard Pressed Steel Co., Jenkintown, Pa. Handbook reviewing both function and facilities of each of three new SPS screw-thread metrology laboratories recently opened by the company for checking threads. 26

LATHE—Sheldon Machine Co., Inc., Chicago, Ill. Circular presenting 15-inch lathe. It points out that this equipment is designed to fill the gap between geared-head and belt-driven lathes. . . 27

CLUTCHES AND BRAKES—Eaton Mfg. Co., Dynamatic Division, Kenosha, Wis. Bulletin RSF-1, describing three new models added to its Dyna-torQ line of magnetic friction clutches and brakes. 28

MAGNESIUM—Dow Chemical Co., Midland, Mich. Booklet entitled "Magnesium in the Electronics Industry," describing the use of magnesium in airborne and air-transportable electronics equipment. . 29

PLATE BENDING ROLLS—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 77E Supplement, introducing 9- and 10-inch diameter plate bending rolls with finger-tip control. 30

BRUSHES—Osborn Mfg. Co., Cleveland, Ohio. Booklet entitled "Osborn TY TOOLS, a new concept of brushing tools for power finishing." It shows various designs and applications. 31

BENDING ROLLS—Wysong & Miles Co., Greensboro, N. C. Bulletin presenting a variety of hand-operated and power bending rolls for many applications. 32

LUBRICANTS AND OILS—Sun Oil Co., Philadelphia, Pa. Booklet giving information on a line of greases and oils. . . . 33

POWER TOOLS—Delta Power Tool Division, Rockwell Mfg. Co., Pittsburgh, Pa. Catalogue AB-58-2, listing and describing lathes, drill presses, tool grinders, and other machine tools. Specifications are given. 34

GAS APPLIANCES—The Linde Co., Division of Union Carbide Corporation, New York City. Circular describing the company's "Prest-O-Lite" LP-gas torch stems, melting furnace, pressure regulators, etc. 35

OPEN TYPE MOTORS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. Bulletin No. 05-51B9040, describing "Super-Seal" open type motors suitable for many applications previously requiring enclosed designs. 36

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ELECTROCLEANER—Oakite Products, Inc., New York City. Folder F 10466, presenting Oakite Composition No. 195, a non-etching reverse-current cleaner. **37**

MULTIPLE-BAR AUTOMATICS—Cone Automatic Machine Co., Inc., Windsor, Vt. Brochure describing "COMAPRO" (Cooperative Machining Project) for determining optimum machining conditions with multiple-bar automatics. **38**

ARC WELDING—Lincoln Electric Co., Cleveland, Ohio. Bulletin 5200.2, describing the principal advantages of multiple-electrode, submerged-arc, tandem welding over single-arc operation. . . . **39**

INDEXING DEVICE—Hartford Special Machinery Co., Hartford, Conn. Folder featuring a 24-inch Super Spacer indexing device. It illustrates the basic 24-inch model and attachments. **40**

BARREL FINISHING COMPOUNDS—Oakite Products, Inc., New York City. Booklet discussing compounds designed for deburring, burnishing, and descaling metals in barrel operations. **41**

HOBBER—Dowding & Doll Ltd., London, England. Brochure describing the versatile Dowding V. 8 universal hobber. . . **42**

METAL STAMPINGS—Dayton Rogers Mfg. Co., Minneapolis, Minn. Folder on stamping and plating services. **43**

AIR CYLINDERS—Lynair Inc., Jackson, Mich. Catalogue No. SA7, telling about non-rotating, double-acting cylinders. It gives data and specifications. **44**

BALERS—Dempster Bros., Inc., Knoxville, Tenn. Brochure presenting six Dempster-Balesters for baling scrap metal. **45**

SPEED REDUCERS—Link-Belt Co., New York City. Booklet No. 2618, listing features, dimensions, and applications of shaft-mounted speed reducers. **46**

SORTER—U. S. Engineering Co., Long Island City, N. Y. Brochure B-35, featuring a precision sorter for machined parts, molded plastics, etc. **47**

CUT-OFF SAWS—Wallace Supplies Mfg. Co., Chicago, Ill. Book on the complete line of Wallace cut-off saws. **48**

BARREL FINISHING—Metal Finish, Inc., Newark, N. J. Bulletin 255, describing their recently announced Vibraslide barrel finishing machine. **49**

CEMENTED-CARBIDE PRODUCTS—Kennametal Inc., Latrobe, Pa. Bulletin No. 59, covering the company's complete line of cemented-carbide products. **50**

REBUILT MACHINE TOOLS—Miles Machinery Co., Saginaw, Mich. Catalogue 209, describing rebuilt machine tools of various types. **51**

SCREWDRIVERS—Detroit Power Screwdriver Co., Detroit, Mich. Brochure describing Model "U" power screwdriver. Specifications are given. Drawings and illustrations show design improvements. **52**

METAL COATING—Industrial Finishes Co., Inc., Philadelphia, Pa. Booklet describing "IFCO" catalytic coating which needs no pre-treatment except that the metal be clean before it is painted. . . **53**

FILTERS—Commercial Filters Corporation, Melrose, Mass. Circular presenting "Fulflo Filters," a new concept of electroplating filtration. **54**

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Speed up RIVETING and CLINCHING

Automatic feeding and setting with T-J

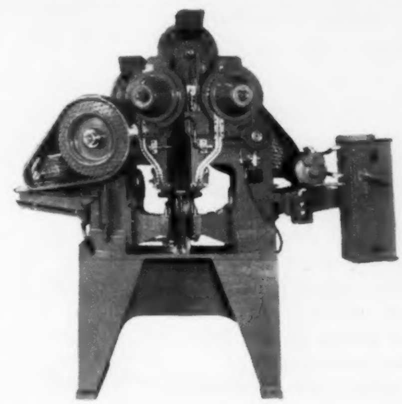
You'll realize *faster assembly . . . reduced labor costs* immediately, when you use T-J Rivitors and Clinchors for your production line. These performance-proved machines are designed to do a wide range of assembly jobs for aircraft, automotive, farm machinery—riveting jobs of *all* kinds.

T-J RIVITORS automatically feed and set solid rivets with high production. Electrically powered Rivitor sets solid steel rivets up to ⅞" long. Throat depths 8" to 36".

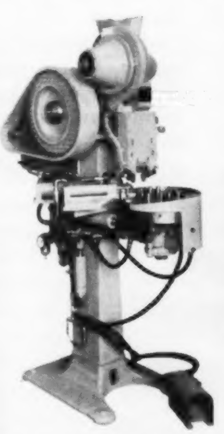
T-J CLINCHORS set clinch nuts with fully automatic operation, controlled by a single foot pedal. Available in Underfeed and Gravity Feed models, throat depths 8" to 36".

Send today for these helpful references: Rivitor bulletins 646 and 555 . . . Clinchor bulletin 555. The Tomkins-Johnson Co., Jackson, Mich.

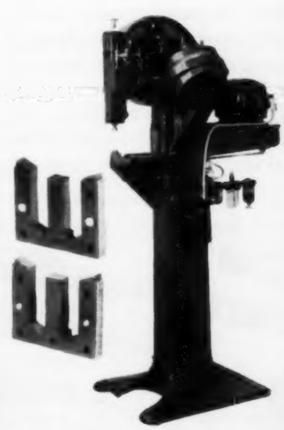
T-J TOMKINS-JOHNSON
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS



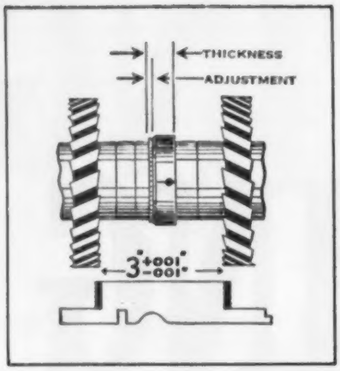
RIVETS 4 AT A TIME! Special quadruple riveting unit, incorporating two Model "RR" Twin Rivitors, mounted on a special welded steel base. Equipped with air-operated hold down mechanism and a safety air trip arrangement. Tooled for riveting left hand and right hand automotive muffler bracket assemblies.



SPECIAL TWIN RIVITOR! Tooled for 6 station indexing fixture, incorporating automatic clamping and ejecting mechanisms, for riveting laminated armature assemblies.



T-J CLINCHOR adapted to a wide range of clinch nut setting problems. Gravity Feed model shown here.



Dayton Rogers micrometer spacing collar for cutter arbors

Micrometer Adjustable Spacing Collars for Milling Machine Cutter Arbors

An improved, micrometer adjustable spacing collar for milling machine cutter arbors is announced by the Dayton Rogers Mfg. Co., Minneapolis, Minn. This is an all-hardened-and-ground unit. It is designed for accurate spacing of all side-milling cutters, gang cutters, gang milling, and various other types of multiple-cutter setups on any type of milling machine equipment.

These collars make it possible to adjust the spacing of the cutters to a very high degree of accuracy. When it is necessary to sharpen and grind them, the micrometer adjustable collar can be readily adjusted to compensate for the material removed by the sharpening operation. Accurate compensation for such variations in side-milling cutters due to sharpening, particularly in straddle-milling operations, is very important and in many cases, absolutely necessary. The precision collars are calibrated in thousandths of an inch. Settings for work requiring greater precision can also be accurately calibrated.

Circle Item 129 on postcard, page 189

Lightweight Gas Appliances

The addition of a complete line of LP-Gas appliances to its Prest-O-Lite soldering, heating, and brazing equipment has been announced by the Linde Co., Division of Union Carbide Corporation, New York City. This new equipment includes open-flame torch stems in six sizes and an enclosed-flame soldering iron stem, all of which fit interchangeably on three styles of torch handles designed to operate in both air-acetylene and LP-Gas service. Adjustable pressure regulators, melting furnaces, and double-duty (air-acetylene or LP-Gas) hose assemblies complete the line.

The new appliances are streamlined and carefully balanced for easy handling in restricted quarters. Each stem is lightweight, yet ruggedly constructed, with a stainless-steel flame cup that serves as a "heat dam," concentrating heat on the work and away from the hands. Sizes of flame cups range from 15/32 inch to 1 1/2 inches in diameter. Fine and superfine models provide pencil flames. Bushy flames are produced by the light, medium, heavy, and extra-heavy stems. Torch handles are available with rear shutoff valve, forward shutoff valve, and pilot flame control, or no valve at all.

The Prest-O-Lite R-416 LP-Gas regulator is a compact, pocket-sized regulator fully adjustable for accurate delivery of pressures from 1 to 60 psi. It fits any LP-Gas cylinder valve with standard CGA 511 (POL female) service outlet. The melting furnace attaches to an LP-Gas cylinder valve and operates from direct vapor pressure. It consumes a gallon of fuel in three hours and burns smoothly in any weather.

Circle Item 130 on postcard, page 189

Cutters for Machining Parts in Steel and Non-Ferrous Metals

The Eclipse Counterbore Co., Ferndale, Mich., is manufacturing and stocking a line of cutters for producing hydraulic port contours in steels and non-ferrous metals. These tools are precision-made and are form-relief ground for simplified resharpening operations and to produce fine micro-finishes. They are made in thirteen standard sizes for hydraulic fittings used with 1/8- through 2-inch outside diameter tubing.

In addition to the standard line, porting cutters for special applications in both high-speed steel and tungsten-carbide tips are available. In cases where it is not feasible to use a pilot in the tap-drill hole, tools are made for use with guide bushings either on the body of the cutter itself or on the outside diameter of the holder.

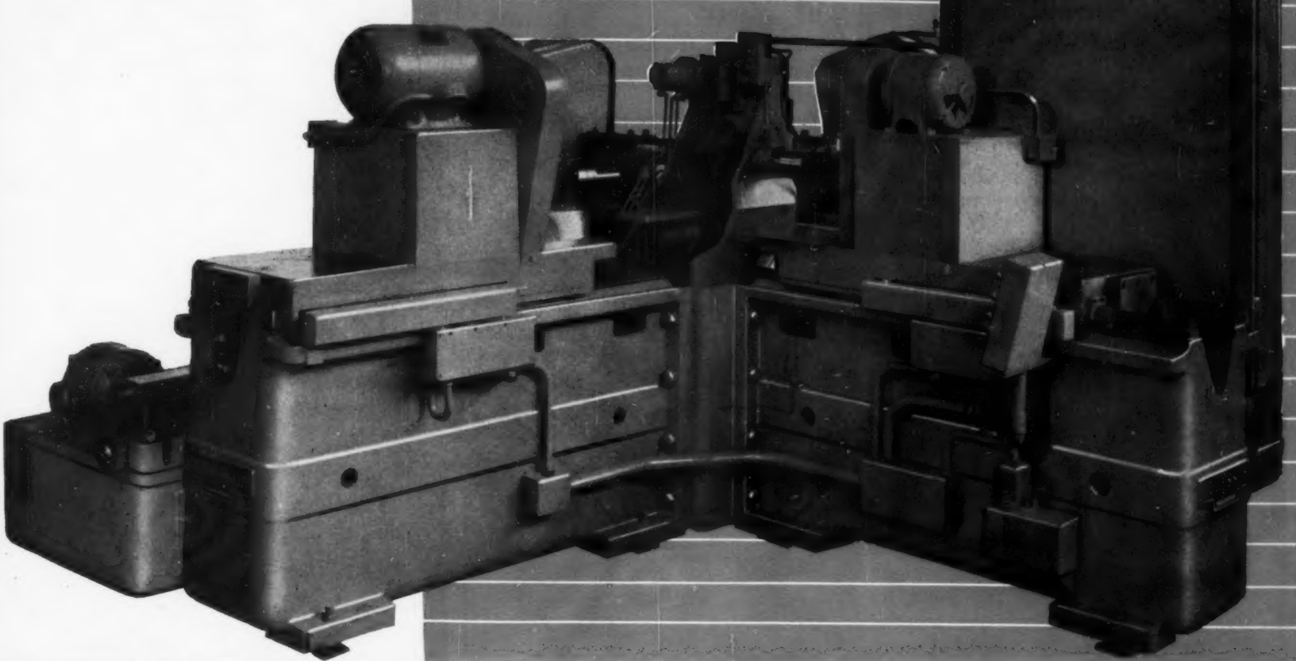
Circle Item 131 on postcard, page 189

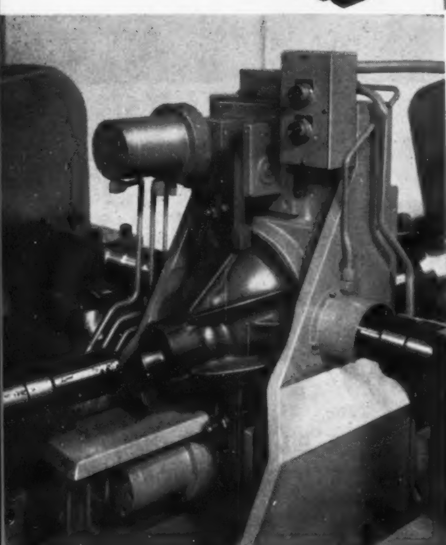
(*This section continued on page 196*)

Prest-O-Lite lightweight gas appliances

Eclipse hydraulic port contour cutter

OLOFSSON *4-Way Machine precision bores 4 holes simultaneously. Holds 90° angles and diameters to .000 5".*





Close-up view of differential carrier, hydraulically cam-clamped in position for boring.

for MORE production and precision, combine 2, 3, or 4 OLOFSSON way units in any COMBINATION

OLOFSSON Precision Way Machines perform fast, accurate boring, facing, turning, grooving, and chamfering. Units are electrically interlocked, and the spindles move to the work.

For long, dependable, and accurate operation Olofsson Way Units feature:

- **Single push-button control panel.**
- **Hardened and ground V-style ways.**
- **Hydraulic control Valves, manifold mounted and located with reservoir.**
- **Parker Majestic precision boring spindle.**
- **Rigid ribbed, nickle iron base.**
- **Adherence to latest J.I.C. recommendations.**
- **Hydraulic pump units located outside base.**
- **Automatic central lubrication system.**
- **Dwell time not affected by positive stop screw adjustment.**

FOR COMPLETE INFORMATION WRITE OLOFSSON CORPORATION OR PHONE LANSING, MICHIGAN, IVANHOE 4-5381.

THE OLOFSSON CORPORATION
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MANUFACTURERS OF PRECISION BORING MACHINES AND SPECIAL MACHINERY

Extension height block announced by Machine Products Corporation

Extension Height Block for Precision Measuring

An extension height block which facilitates making both height and width measurements in inspection, layout, and prototype operations, is announced by the Machine Products Corporation, Detroit, Mich. This precision measuring device makes it possible to move inspection equipment (height gage and indicator, for example) closer to the work-piece. It also eliminates the need for excessive extension arm lengths. As a result, better control of measuring devices can be maintained.

The block can easily be built up to any height requirement. It is a one-piece Meehanite casting sturdily constructed for long-lasting accuracy, yet is light enough for easy handling. The standard over-all height is 10 inches, plus or minus 0.0005 inch. Ample clamping surfaces are provided for the attachment of measuring devices. There is also space to permit clamping the block in position for the application of heavy equipment on the reach ledge. Sizes other than the standard 10-inch model are also available.

Circle Item 132 on postcard, page 189

Retaining Ring Kit

A retaining ring kit containing 376 cadmium-plated Truarc retaining rings, with each size packed individually in a numbered envelope, is being produced by Bearings, Inc., Cleveland, Ohio. Rings for shaft sizes range from 1/4 to 2 1/2 inches in the three most-used Truarc series of internal, external, and universal crescent ring designs. Sizes and designs in the kit represent about 70 per cent of the retaining ring sizes now being used in industrial, automotive, aircraft, and marine applications. All rings meet the National Aircraft Standards, NAS 669 and 670. Complete interchange information is supplied with every kit.

Circle Item 133 on postcard, page 189

Ingersoll-Rand Impactools

Two new models have been added to the line of air-powered Impactools made by Ingersoll-Rand, New York City. The Size 5081T torque-control Impactool illustrated is for applications where accurate torque control in the 50- to 150-foot pound range is required. When the pre-set torque is reached, the tool shuts off automatically. A companion tool, the Size 5081 Impactool, not shown, is designed for nut-running jobs up to the 5/8-inch bolt size.

Ingersoll-Rand torque control Impactool

Both tools embody a number of advanced design changes. These include an air-balanced throttle valve for easily controlled throttle graduation and trigger pull. Also, the muffling has been designed so that the operating air passes through three expansion chambers which eliminate all disagreeable exhaust noises. Complete one-hand control of the tool is afforded since reversing is accomplished by shifting a small lever within easy reach of the thumb.

The 5081T torque control Impactool runs at a free speed of 1350 rpm, and will deliver 2000 impacts per minute at 90 psi air pressure. It weighs 9 7/8 pounds, has an over-all length of 12 11/16 inches.

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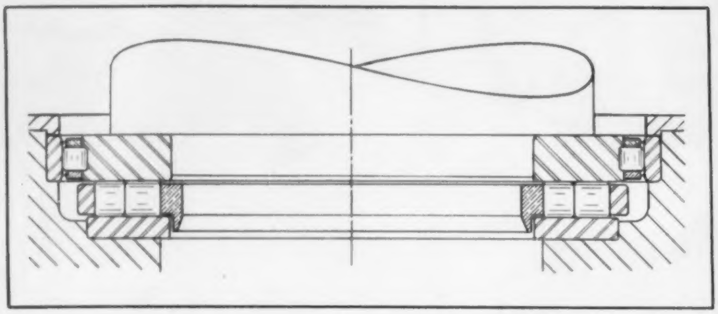
(*This section continued on page 198*)



Rollway combination thrust and radial bearing

Combination Thrust and Radial Bearing

A dual-duty cylindrical roller bearing, designed for applications where both thrust and radial loads must be carried in a restricted space, is being manufactured by the Rollway Bearing Co., Syracuse, N. Y. Actually two bearings in one, this unit consists of two roller assemblies (radial and thrust), with the flanged inner race of the radial section serving at the same time as the revolving plate of the thrust section.

The outer race of the radial bearing is stationary with respect to the inner race, and is completely separable. This construction facilitates assembly where space is restricted. A step in the bore of the bearing retainer serves as a means of locating the thrust roller assembly in the bore of the stationary thrust plate. The radial portion of the bearing is located on the shaft.

The bearing, designed for both continuous and intermittent operation, is available with bronze or Rollube retainer.

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Mo-Max Ground T-Shaped Cut-Off Blades

The Cleveland Twist Drill Co., Cleveland, Ohio, announces an improved line of Mo-Max ground, T-shaped cut-off blades. A new method of grinding these blades is said to assure extremely high accuracy in all dimensions. Head and body are always equidistant from the center line. This provides complete interchangeability and saves setup time.

The top of each blade is ground with a radius so that the chips are crimped. Chips are narrower than the blade itself, resulting in a cooler running tool, less scoring on the sides of the cut, and easier application of coolant.

The blades are made both in high-speed steel and cobalt high-speed steel. The high-speed steel blades are heat-treated to provide superior cutting qualities. Blades of cobalt high-speed steel are said to give best results under difficult conditions, and to have a high degree of red hardness. They are available in nineteen sizes, ranging from 0.040 by 1/2 inch by 3 1/2 inches long, up to 1/4 inch by 1 1/8 inches by 6 1/2 inches.

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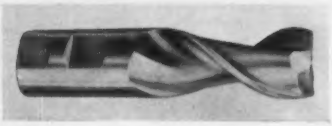
Cleveland Mo-Max ground T-shaped cut-off blade


POTTER &



One of thirty-nine high-speed end-mills in Brown & Sharpe line

Brown & Sharpe High-Speed Steel End-Mills

Thirty-nine high-speed steel end-mills have been added to the standard line of the Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence, R. I. These cutters are designed for milling aluminum and aluminum alloys. Generous chip clearance and use of a special abrasion-resistant, high-speed steel is said to improve performance and greatly lengthen the life of these tools. Other features include 40-degree helix and 20-degree rake angles, a combination designed to give a shearing cut of maximum efficiency on aluminum.

A completely ground finish over the entire mill surface with ground eccentric relief of the sharp precision cutting edge serves to improve the production capacity of the tools. These new end-mills are available in three different lengths—standard, long, and extra long. Sizes range from 1/4 inch to 2 inches in diameter.

Circle Item 137 on postcard, page 189

Leland-Gifford Tracer Attachment for Lathes

A tracer attachment made in three sizes to fit lathes up to 27 1/2-inch actual swing and up to 30-hp capacities has been brought out by the Leland-Gifford Co., Worcester, Mass. This attachment converts any lathe into a production machine.

This attachment is not limited to quantity production applications, but can be employed to advantage on maintenance and tool work for copying otherwise costly replacement parts. The micrometer adjustment on the tracer stylus makes it possible to easily hold work to the required diameter.

Both round and flat templates of either wood or metal, as well as a standard work-piece, may be used. The tracer automatically controls the tool in its continuous path, providing a smooth, accurate finish that in many cases will eliminate final grinding.

The adjustable eccentric on the template tailstock center guides the tool for start of cut and prevents it from running into the lathe tailstock center. The tool-post and holders allow quick and positive interchanging of pre-set tools. Complete swiveling gives the attachment limitless range for turning and boring. The tracing unit may be swivelled to any angle in the same manner as the tool-slide, which it replaces.

In operation, the tracer stylus and tool approach the cutting position in rapid traverse. The longitudinal feed of the lathe is engaged and the tracer stylus controls tool position accurately to the end of the cut. With the swivel set at 60 degrees to the axis of the work, it is possible for the tool to fall 30 degrees (60 degrees included angle) and rise at 90 degrees, thus simplifying square-shoulder work.

This attachment can be used as a power-feed, compound tool-slide with rapid traverse and adjustable stop for shifting from rapid traverse to feed and a hydraulic feed adjustable from 1 inch to 35 inches per minute.

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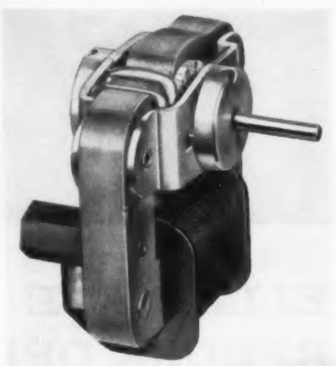
Tracer attachment for lathes brought out by the Leland-Gifford Co.



Improved alternating-current motor

Barber-Colman Improved Small-Sized Motor

Improved alternating-current motor of the smallest size made by the Barber-Colman Co., Rockford, Ill. This type A motor has been given substantially greater efficiency without any increase in over-all dimensions. It is being used where space and size are critical, and low noise, high torque, and long life are essential. Fan blades in 2- to 4-inch sizes can be attached for use in deodorizers, electronic equipment, and blowers. Reroll chart drives, fans, stirrers, and gear-train drives are just a few of the many possible applications of this motor.

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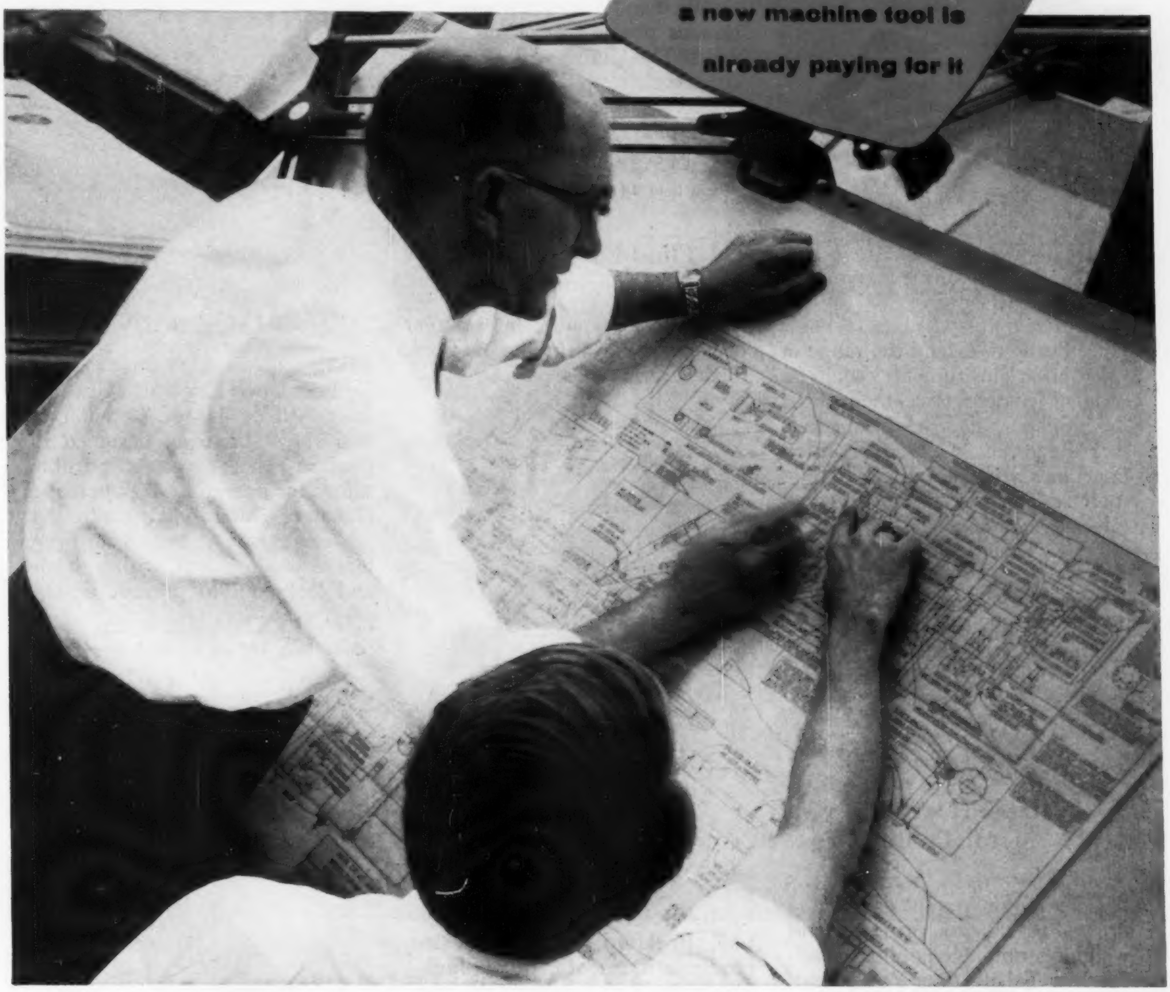
(This section continued on page 202)

JONES & LAMSON
MACHINE COMPANY



Your good ideas . . . how long do they live?

The answer is simple: They live only as long as top management in your company is *convinced* that they will be profitable. The hard part is in the convincing. Particularly when initial capital expenditures are necessary.

Want some help? Our new 16mm. color-and-sound movie, "The Price of Eggs", tells how to move a production idea toward profit. It can be related to methods changes, production volume, new designs, new products, or *any* facet of your operation which deals with keeping manufacturing costs competitively low. And it contains no "commercial". A group showing to your top production and management people will be an eye opener. It's yours—with no obligation.

Write to Jones & Lamson Machine Co., 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

For more data on any products advertised this issue use card, page 189

Simplex Set of Gage-Blocks

Set of simple gage-blocks made specifically to extend the range of measuring instruments such as optical comparators, toolmaker's microscopes, coordinate measuring stages, as well as precision machines, including small jig borers. This set of seven gage-blocks, announced by Opto-Metric Tools, Inc., New York City, consists of 1/16-, 1/8-, 1/4-, 1/2-, 1-, 2-, and 3-inch gage-blocks in a hardwood case. The guaranteed accuracy is plus 0.000006 inch and minus 0.000002 inch.

Circle Item 140 on postcard, page 189

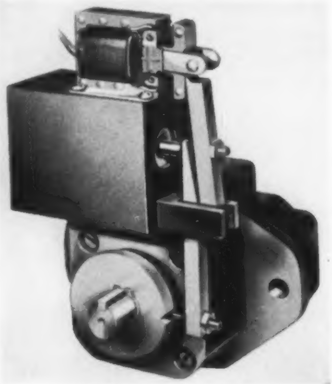
Portable Heavy-Duty Motor Pump

Small, powerful, portable hydraulic motor pump developing up to 10,000 psi pressure and weighing only 65 pounds developed by Tal Bending Equipment, Inc., Milwaukee, Wis. Besides being used with Tal hydraulic pipe benders, or any other make of hydraulic benders, pipe pushers, knockout punches, or hydraulic jacks of any kind, it can readily be installed and adapted to give continuous power to existing equipment. The pump will deliver 80 cubic inches of oil per minute and is driven by a standard 1/2-hp, single-phase, 60-cycle motor having a speed of 1750 rpm.

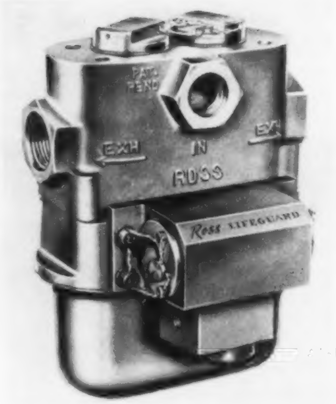
Circle Item 141 on postcard, page 189

Fluid-Powered One-Revolution Drive

Accurate, automatic, intermittent drive unit for indexing motions, feeders, turntables, packaging machinery, office equipment, and similar applications announced by the John S. Barnes Corporation, Rockford, Ill. This device produces a smooth, quiet, high-torque drive that picks up the load instantly. It consists of fluid motor, planetary reduction gearing, and solenoid-actuated starter. A built-in valve provides for compensation during the driving movement and unloading during the stationary or dwell period. There is a cam and adjustable-finger lever arrangement that provides rapid, smooth acceleration and deceleration, as well as positive stopping. The drive can also be arranged for manual or mechanical starting, or multiple-revolution operation. Available in a wide range of output torque capacities and speeds. Approximately 6 by 5 by 7 inches high.



Circle Item 142 on postcard, page 189



Ross Lifeguard Valve

Lifeguard valve made available by Ross Operating Valve Co., Detroit, Mich. This "C" version of this valve has been designed to provide the greatest possible safety for operators of pneumatic clutch or clutch-brake controlled power presses. It senses any potential malfunction within itself and locks out to prevent unsafe press operation.

Circle Item 143 on postcard, page 189

Starrett Low-Carbon Flat Stock

Precision-ground flat stock, No. 498, of exceptionally high machinability that offers the economy of a low-carbon steel plus lower machining costs, easier and faster production, and better finish. Introduced by the L. S. Starrett Co., Athol, Mass., this material has a machinability rating of 91 per cent against 72 per cent for most low-carbon steels. Be-

cause it is precision ground to accurate size, a wide variety of work having two flat, parallel sides can be produced by simply laying out and cutting to the required shape. It is available in 24-inch lengths in widths from 3/8 inch to 16 inches and in thicknesses from 1/16 inch to 2 7/8 inches.

Circle Item 144 on postcard, page 189

Leitz Auto-Collimator

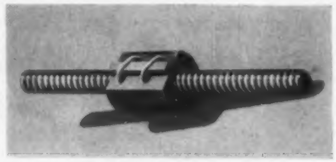
Precision auto-collimator of Leitz-Wetzlar (West German) make announced by Opto-Metric Tools,

Inc., New York City. This compact optical tool is completely self-contained and independent of any mounting fixture. Even the ocular element is rotatable against stops over an exact 90-degree quadrant for measurements in two planes. Minutes and fractions of seconds are read within the one eye-piece. Provision is also made for independent zeroing for the initial setting.

Circle Item 145 on postcard, page 189

Miniature Ball-Bearing Screw for Mechanisms

Miniature, lightweight, ball-bearing screw with only 3/16-inch ball-circle diameter that provides 90 per cent or more efficiency, developed by Saginaw Steering Gear Division of General Motors Corporation, Saginaw, Mich. This ball-bearing screw, said to be the smallest ever developed, is designed for use in electronic controls, radar tuners, missile and rocket guidance and telemetering systems, automatic switching devices, electronic machinery controls, and many other engineering



applications where critical positioning and control problems are encountered.

Circle Item 146 on postcard, page 189

Ruthman "Sealess" Gusher Pump

Model 5P-4521 sealess gusher pump with triple discharges which may be used individually, simultaneously, or in any combination made by the Ruthman Machinery Co., Cincinnati, Ohio. This pump is available in two lengths. It has no seals or metal-to-metal contacts and will handle clean coolants, as well as liquids containing grit and abrasives. Especially adapted for use on grinding, honing, and lapping machines. Available with 1/10- and 1/4-hp motors operating at 3450 rpm for heads up to 30 feet and capacities up to 30 gallons per minute.

Circle Item 147 on postcard, page 189

Shearcut Tool for Finishing Holes

Tool for producing precision holes, called the Shearcut "Gizmo," developed by Shearcut Tool Co., Roseda, Calif. This inexpensive tool is said to produce holes to extremely close tolerances through a combined burnishing and compression action. The latter action stresses the material being worked beyond its elastic limit as the tool is fed into the hole. This tool may be used in automatics, lathes, drill presses, etc. It is particularly adaptable to finishing holes in non-ferrous materials. Stock sizes are from 1/16 to 1 inch inclusive.

Circle Item 148 on postcard, page 189

High-Lift Parts Feeder for Automated Lines

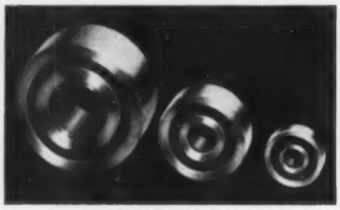
High-speed motor-driven equipment for automatic high-lift elevating of parts in automated production lines developed by the Gear-O-Mation Division, Michigan Tool Co., Detroit, Mich. This unit also orients parts and feeds them into distribution systems at a rate of 3600 parts per hour.

Circle Item 149 on postcard, page 189

(This section continued on page 206)

Tru-Hone Diamond Dresser

"Tru-hone" diamond dresser designed to provide a fast, economical method for truing up honing stones developed by Staple Engineering Co., Birmingham, Mich. The dresser also acts as a guide in establishing the size setting. It contains thousands of small dia-



monds, metal-bonded into a ring or bushing of the same inside diameter as that of the part to be honed. This ring is assembled into a holder of suitable length and diameter for ease of handling or into a holder that is located in a honing fixture. In use, the honing stones are adjusted slightly oversize (approximately 0.001 inch). The machine spindle is then started. While rotating, the dresser is stroked over the stones. Usually, one or two strokes will produce true stones in seconds. The long life of the diamonds makes possible thousands of dressings without appreciable wear in the dresser.

Circle Item 150 on postcard, page 189

Fafnir Pillow-Block Ball Bearing

Standard series LAKH pillow-block ball bearing just introduced by the Fafnir Bearing Co., New Britain, Conn. This pillow block has been designed to meet specific customer requirements for vary-

ing over-all dimensions. It is similar in design and has load capacities comparable to those of other standard series Fafnir pillow blocks. A wide, inner-ring ball bearing incorporates the Fafnir patented Mechani-Seal.

Circle Item 151 on postcard, page 189

Tube Cutter and Flaring Tool Set

Tube cutter and flaring tool set now being manufactured by J. H. Williams & Co., Buffalo, N. Y. This set includes one each of No. 161 tube cutter, No. 161-A extra cutter wheel, and No. 162 flaring

tool with compressor attachment. These tools, packaged in a strong, attractive, steel case, are all that are necessary for quick, efficient cutting and flaring work on copper, brass, and aluminum tubing in seven diameter sizes ranging from 3/16 to 5/8 inch. The chromium-plated No. 161 tube cutter will cut tubing from 1/8 to 1 inch in diameter.

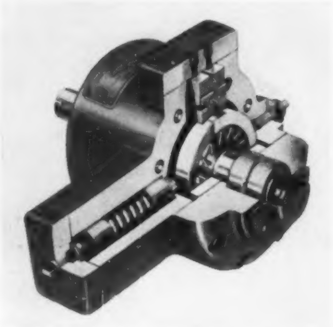
Circle Item 152 on postcard, page 189

Airco Regulator for Gas Flow

Single-stage, inverse type, gas-flow regulator of 8100 series announced by the Air Reduction Sales Co., A Division of Air Reduction Co., Inc., New York City. Each regulator in this series, whether for oxygen, acetylene, hydrogen, nitrogen, argon, helium, or carbon dioxide, is designed to provide a substantially higher delivery rate and maintain a more constant delivery pressure than preceding

models. The new regulators also permit the gas to be more completely exhausted from the cylinder. The spring case and low-pressure cavity can be easily opened for inspection, service, and removal of diaphragm. The sure-grip brass adjusting knob is a change from the usual T-bar type. The series includes regulators specifically engineered to meet the flow-rate demands of such operations as heating, heat-treating, lead burning, welding, cutting, flushing of molten metals, food packing, and inert-gas-shielded arc-welding.

Circle Item 153 on postcard, page 189



Variable-Volume Vane Type Pump

Model S variable-volume vane type pump for hydraulic circuit power applications announced by Racine Hydraulics & Machinery, Inc., Racine, Wis. This pump has a capacity of 10 gallons per minute. It is designed to operate at 1000 psi at a speed of 1800 rpm. It provides a flexible source of power for a variety of machine applications and fills out the manufacturer's range of pump sizes.

Circle Item 154 on postcard, page 189

(*This section continued on page 208*)

JONES & LAMSON OPTICAL COMPARATORS

the man who needs a new machine tool is already paying for it

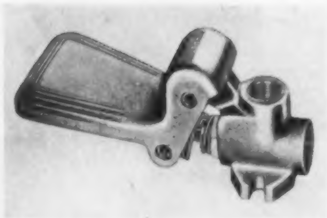
J & L Comparators produce the sharpest, blackest shadow images

You've often heard the phrase, "There's more to it than meets the eye." This couldn't be truer than when referring to different types of Comparator performance. Screen illumination on J & L Comparators doesn't just *appear* to be brighter—it *is*. Prove it to yourself with a light meter. While doing this you'll find that J & L not only *produces* more illumination—but also *stops* more. Shadow images (which is what we really measure or inspect) are sharper, denser and distortion-free.

And here's something else; J & L Comparators are now being equipped with a NEW VARIABLE LIGHT INTENSITY switch, with built-in filament warm-up. Projection lamp life is materially increased as controlled screen illumination with maximum brilliance is assured. Illumination is reduced when using low magnification lenses and is increased for the higher power lenses. Light potential is used only as required, and lamps last longer.

Write for catalog 5700, which describes many features resulting from J & L's continuous research in optical inspection. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



Foot-Operated Two- and Three-Way Valve

Poppet type valve actuated by only a light "tiptoe" action on foot pedal, introduced in two- and three-way styles by A. Schrader's Son, Brooklyn, N. Y. The surface-mounted valves are packed complete with the foot pedal. Spring action closes the valves on release of the pedal. The two-way foot-operated valve, with air-flow capacity of 75 cubic feet (based on cubic feet of free air per minute at 100 psi inlet pressure), has 3/8-inch NPT parts, designed for use where limited space is a factor. All parts are made of corrosion-resistant material and are readily accessible for servicing. The three-way foot-operated valve, with an air capacity of 75 cubic feet, is similar to the two-way valve, except for replacement parts.

Circle Item 155 on postcard, page 189

Scherr Precision Comparator

"Super - Compar - It" comparator with 0.000020-inch graduations (20 millionths of an inch) introduced by the George Scherr Co., Inc., New York City. The instrument has a dial range of plus or minus 0.001 inch and vertical capacity of 4 inches. The measuring accuracy over the entire range is plus or minus 0.000010 inch (ten millionths of an inch). It thus permits the accurate reading of fractons of 0.0001 inch directly. The gaging head is completely jewel equipped, including a sapphire-tipped contact point to minimize wear. It is absolutely shockproof. Tolerances can be indicated on the outside of the dial window by simple hand-movement of two markers. An important feature is the zero adjustment of the indicating hand by means of a knob control. A cable release lifts and lowers the contact point by remote control, thus protecting the indicator from the heat of the operator's hand, unequal pressure, and vibration. The instrument is only 2 1/2 by 3 3/4 inches, making it well-suited for use where working space is limited.

Circle Item 156 on postcard, page 189

Heavy-Duty Foot-Switch

Heavy-duty, foot-operated switch of line recently redesigned by the Allen-Bradley Co., Milwaukee, Wis., to meet a greater variety of operating needs. This Bulletin 805, Style A foot-switch has a base and a cover made of sturdy, lightweight aluminum die-castings. Three different styles are available. One provides a guard extending over the top of the foot-treadle. The second has a guard covering the top and sides of the foot-treadle, and the third is of the open treadle type. These switches may be furnished with a latch for holding the treadle in the down position. They come in various enclosure styles and contact ratings.

Circle Item 157 on postcard, page 189

Computer for Evaluating Metal-Cutting Problems

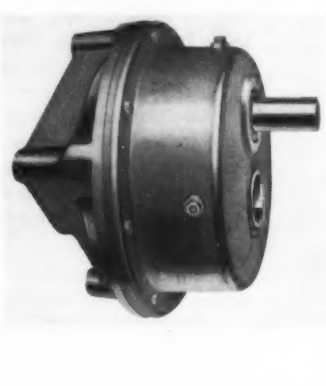
Portable Cutmeter designed and developed by Kennametal Inc., Latrobe, Pa., for use in the evaluation of metal-cutting conditions.

It can be used also for establishing machining practices on new operations. The computer puts into convenient form the relationships of feed, speed, depth of cut, power, etc., which have been established through metal-cutting research. Practical feeds and speeds for starting a job are quickly obtained by direct setting of the dials. The Cutmeter, fitted in a case 5 1/2 by 10 1/2 by 14 1/2 inches, weighs 8 pounds.

Circle Item 158 on postcard, page 189

Falk Flange-Mounted Drive

Compact gear drive that can be bolted directly to the driven machine, made by the Falk Corporation, Milwaukee, Wis. The unit is designed with bearing capacities for overhung and thrust loads to allow installation on the driven machine as a geared pillow block, if desired. Thus, it is possible to



SAVE

On Base Price! On Set-up Time! On Maintenance!

Typical parts produced by 2½" Model AW Cleveland, at profitable production rates, with simple tooling. Ask your CLEVELAND representative to submit a cost analysis with production estimates on your work.

REMEMBER,
Clevelands Cut Costs!

with the low-cost CLEVELAND
2½" model AW single spindle automatic

With a base price of $4000 to $5000 *less* than other comparable automatics, this Model AW Cleveland will set an unbeatable production pace in your shop. Not only is it fast, precise and highly versatile, it is a rugged, *fool-proof* automatic, free from complicated mechanisms and controls that require constant adjustment and maintenance.

Quick and easy to set up, this Cleveland features universal camming — rapid, hand crank stock feed adjustment—quick change collet pads—four automatic spindle speeds for each set of pick-off gears. An easily accessible tooling area is provided by wide, independent double cross slides and large diameter 5-hole turret. Forty spindle speeds —69 to 1920 rpm—give you efficient speeds for all types of materials and tools. Forward and return turret tool feeds are infinitely variable through a simplified mechanical drive.

With the 2½" Model AW Cleveland, you can *cut your costs three ways:*—ON BASE PRICE—ON SET-UP TIME—ON MAINTENANCE. For detailed machine specifications, write for AW Bulletin.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4936 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFORD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

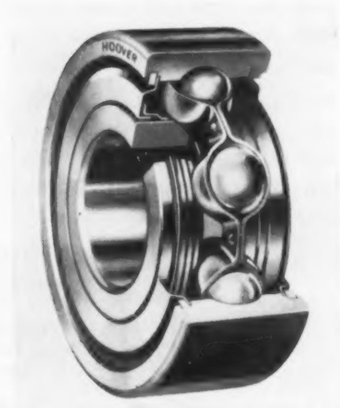
eliminate one machine bearing and cut down the over-all size of the installation. The drive is built to AGMA recommendations and is available for horizontal or vertical applications. It can be furnished from stock in single reduction for applications of 1/2 to 10 hp, and in two double-reduction ratios for 1/2 to 5 hp.

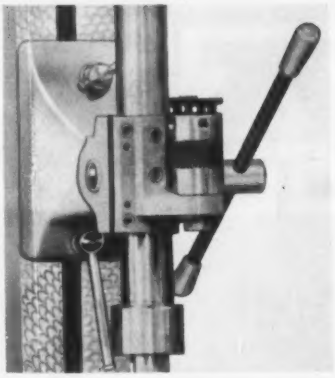
Circle Item 159 on postcard, page 189

Hoover Cartridge Ball Bearing

Cartridge ball bearing with dual labyrinth seal that holds a lifetime supply of lubricant and has a "slinger action" to circulate the lubricant for maximum performance. This development of the Hoover Ball & Bearing Co., Ann Arbor, Mich., is designed to standard double-row bearing widths. It has extra-large reservoirs to hold the lubricant, which is applied at the factory. The dual labyrinth seals, which lock in the lubricant, are formed by an inner and outer shield, fitted to create both a horizontal and vertical labyrinth. Running tolerances are so close that there is no chance for the lubricant to escape or for dirt to enter the bearing. The inner shield, rotating with the inner raceway of the bearing, provides the centrifugal force that "slings," or returns, lubricant again to the working surfaces, regardless of bearing position. This bearing is precision made with Hoover-honed raceways and Micro-Velvet balls that are accurate within millionths of an inch.

Circle Item 160 on postcard, page 189





Edlund Turret Depth Stop

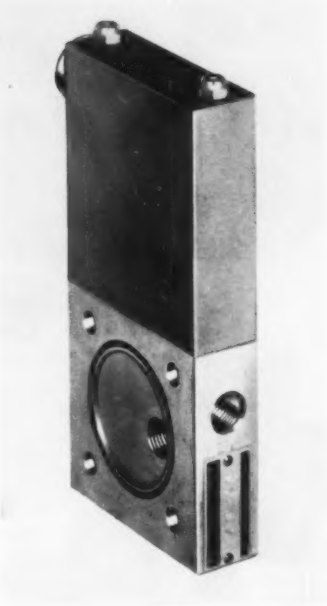
Turret depth stop introduced by the Edlund Machinery Co., Cortland, N. Y. This device is designed to simplify production when multiple drilling operations are performed on one spindle. The unit has four positions, each of which can be set for a predetermined depth. Each pre-set depth can be repeated accurately as many times as required. A depth adjustment range of 2 inches is available at each position.

Circle Item 161 on postcard, page 189

Grimes Precision Hand Tapper

Hand-tapping device for producing precision threads in a size range of from No. 0 to 1/2 inch announced by the Grimes Engineering Corporation, Cheshire, Conn. Designed as a machine tool accessory to be used with drill presses, lathes, jig-borers, and vertical millers, this tapper eliminates the need for individual hand-tapping machines and devices. The standard No. 2-A chuck tapper makes removal of the tap chuck and its replacement with a standard acorn threading die or die-holder a simple matter when changing over to threading operations. Accurate calibrations on the spindle shaft give instant depth reading of tap.

Circle Item 162 on postcard, page 189

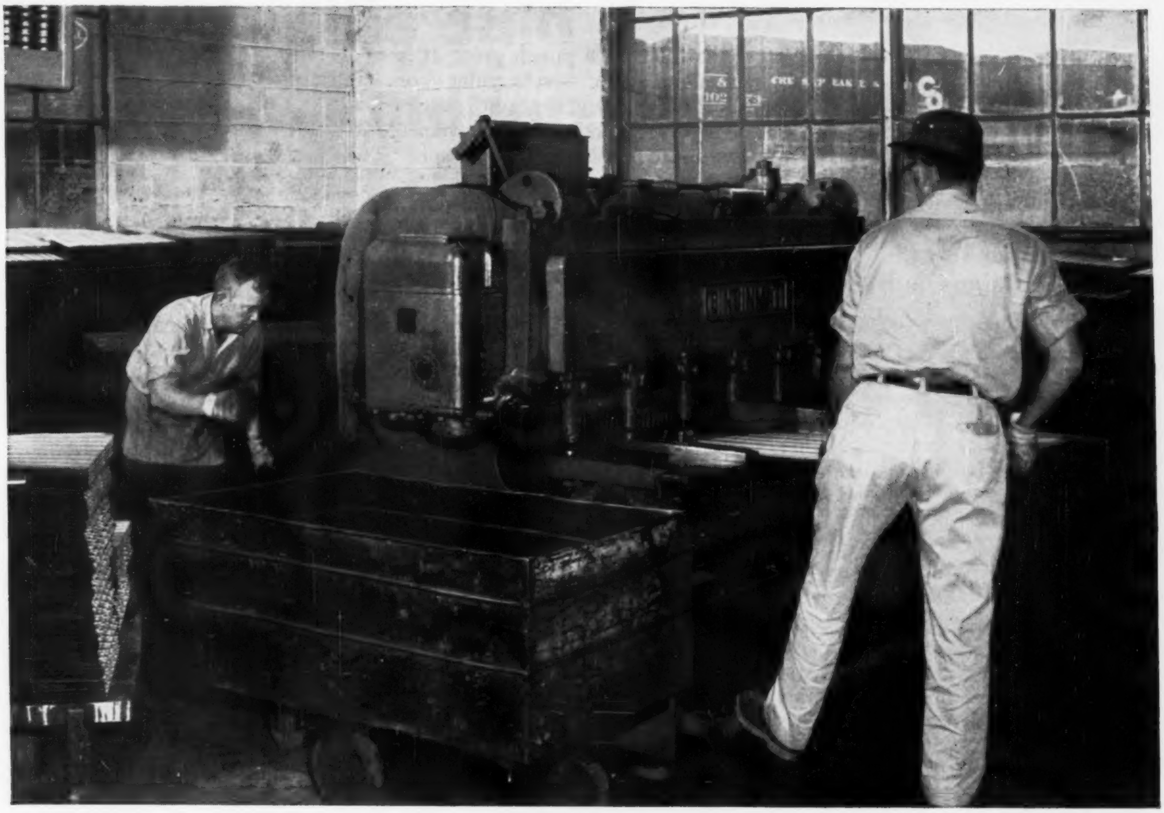


Quick-As-Wink Solenoid Control Valve

Quick-As-Wink solenoid-operated, S-3C-S valve, only 1-inch thick, 3 inches wide, and 6 1/16 inches high, introduced by C. B. Hunt & Son, Inc., Salem, Ohio. This streamlined valve can be mounted easily on machines and machinery even when space is extremely limited. It can be used with air or oil; pressures to 125 psi; and temperatures to 150 degrees F. Furnished tapped for either 1/8- or 1/4-inch pipe connection; rated at 300 cycles per minute for continuous operation; and up to 700 cycles per minute for intermittent service on air at 120 pounds per square inch. These valves are available in "normally closed" or "normally open" three-way designs, or with four-way action. They can be manifolded together quickly without special parts.

Circle Item 163 on postcard, page 189

(This section continued on page 212)



PRODUCTION: 10,000,000 cuts
MAINTENANCE COST: $896.00

This Cincinnati® Shear has been in constant service for ten years, cutting 18-gauge corrugated sheet, 1010 draw quality, for a prominent heating equipment manufacturer at an average rate of 4000 cuts a day. That adds up to more than a million strokes per year — or 10,000,000 strokes in ten years.

Accuracy has always been excellent. The machine has been "down" *only for blade changes.* Special blades are used in this operation, to eliminate distortion of the corrugations.

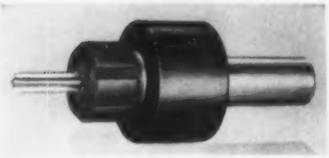
Cost of machine maintenance, including blade resharpening, has been $896.00 for the entire ten years. "This," says their production manager, "to my way of thinking, is very good performance." We agree. Yet this is not exceptional. Every Cincinnati® Shear is built to provide this kind of dependability and low maintenance, and we have hundreds of case histories to prove the point.

Specify Cincinnati® for all your shear requirements. Write Department D for Catalog S-7R.

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.



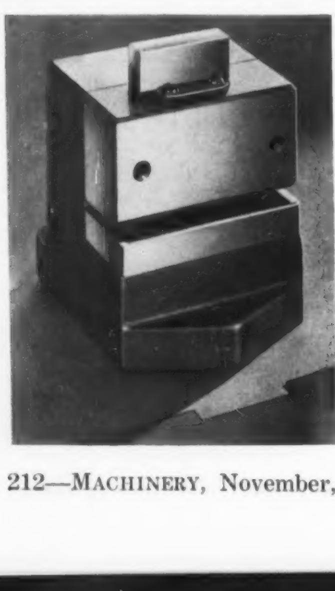
Releasing Tap Chuck and Threading-Die Holder

Self-releasing tap chuck developed by the Universal Engineering Co., Frankenmuth, Mich. Screws or sleeves are not needed with this chuck. The collets are interchangeable with all other chucks made by the manufacturer. The releasing tap chucks have been designed for simplicity and compactness, without springs, cams, or pawls which tend to break and wear out. They can be used for either right- or left-hand tapping without adjustment. The Universal releasing type threading-die holder which works on the same self-releasing principle as the releasing tap chuck is also available. This holder is equipped with a standard Acorn die-holder for accommodation of precision U.S.S. Acorn dies, and is adjustable for correct pitch diameter.

Circle Item 164 on postcard, page 189

Wales-Strippit Notching Unit

One of a line of standard notching units introduced by Wales-Strippit, Inc., Akron, N. Y., a unit of Houdaille Industries, Inc. This unit is designed for notching mild steel sheet materials up to 1/8 inch thick on a punch press. It is available for rectangular or V-edge notching, for radius notching, or for any irregular shapes within the physical limits of specified models. Available in 1 1/2- by 1-inch to 3- by 8-inch sizes.



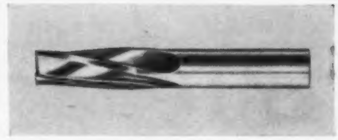
Circle Item 165 on postcard, page 189

Onsrud Heavy-Duty Portable Router

Heavy-duty, portable router with push-button selection of power drive announced by Onsrud Machine Works, Inc., Chicago, Ill. At the low position, the router

motor operates at 1/2 hp, 40,000 rpm; and at the high position, at a full 1 hp, at 50,000 rpm. The push-button is positioned for easy finger-tip control without requiring the operator to move his hand from the normal holding position. This W-222 portable router is driven by a high-efficiency, high-torque, air turbine motor, giving an unusually high horsepower and sustained load speed at minimum air consumption. Only 14 cubic feet per minute of air at 90 to 100 pounds per square inch pressure is needed for operation at the 1/2-hp drive level, and only 26 cubic feet per minute is needed at 1 hp. The router is designed for all types of portable routing operations in non-ferrous metals, laminated materials, and wood.

Circle Item 166 on postcard, page 189



Atrax Spiral-Fluted End-Mill

Spiral-fluted end-mill introduced to the metalworking market by Atrax Co., Newington, Conn. This new Series 1505 end-mill can be run at slow speeds without injury to the cutting edge. It is especially recommended for machining stainless steels, stellite, titanium, nickel, chromium, Monel metal and various high-temperature steels. There are sixteen individual end-mills available in this series. Fractional sizes range from 1/16 to 3/4 inch in diameter.

Circle Item 167 on postcard, page 189

Self-Tapping Inserts

"Speed-Sert" self-tapping insert and tool made by Newton Insert Co., Los Angeles, Calif., to eliminate the separate tapping operation common to most insert installations. Four extra-sharp cutting edges enable the Speed-Sert to cut its own thread as it is rotated into a cored or drilled hole, using a simple installation tool which fits into a standard tapping head. These inserts are designed for low-cost, speedy installation in aluminum and magnesium alloys and plastics to provide a steel thread in the softer-than-steel materials. Available in carbon or stainless steel and brass.

Circle Item 168 on postcard, page 189

By E. S. Salichs

BETWEEN GRINDS

But Don't Stutter

A new engineering development now under way at Bell Telephone Laboratories concerns TASI (time assignment speech interpolation). Today, twin ocean cables, one for each direction of talking, can carry thirty-six conversations at once. But the plan is for TASI to double its capacity by taking advantage of the times when people are listening or pausing. The voice channels they leave temporarily unused will be automatically assigned to other talkers. Simply stated, this means that while you are having an overseas conversation with your wife, someone else can be using your time on the line.

Less Bumps to the Mile, Motorists will Smile

The rhythmic road shock that motorists encounter on highways will be reduced if those constructed in the future will make use of a rubber expansion joint developed by B. F. Goodrich. The joint is a new concept, according to Goodrich president C. O. DeLong, who said, "It permits, for the first time, as much as 3 inches of contraction and expansion in the highway or runway while keeping the rubber flush with the surface."

Short Pants and Plants

"Providing a plant for a small company is like buying an expensive suit for a thirteen-year-old boy—if all goes well, both will outgrow their clothes in a short time." So saying, the Small Business Administration has issued a new booklet to advise about alterations. *Profitable Small Plant Layout*, No. 21, Superintendent of Documents, Government Printing Office, Washington 25, D. C., price, 25 cents.

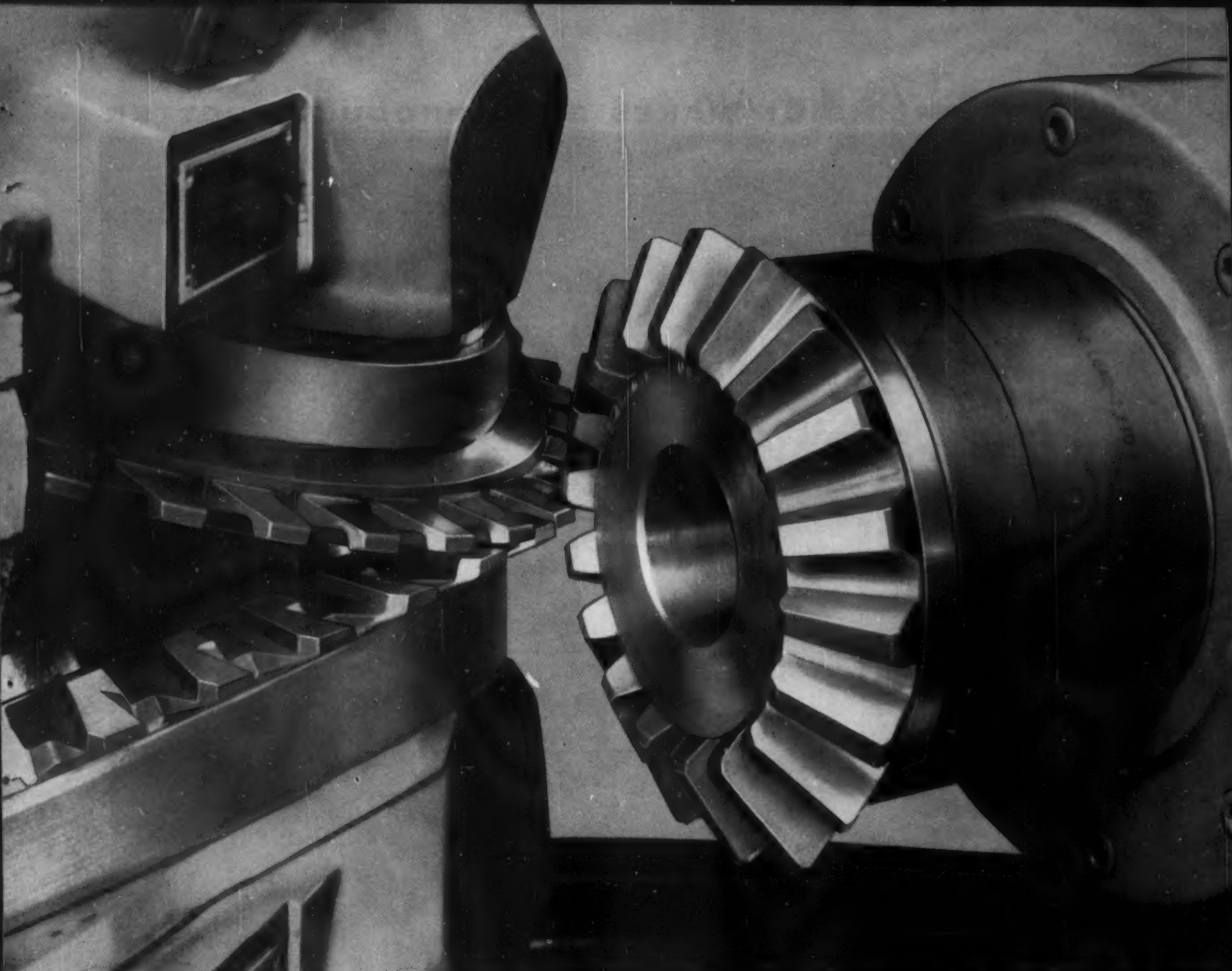
We Catch "L"

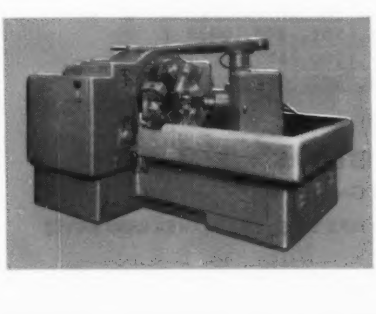
Subscriber Frank Kozlowski jovially complained to our Editor, Charles O. Herb, that, although he was receiving MACHINERY, the "l" had been dropped from his name. Mr. Kozlowski, who had spent eleven months in Ireland in 1942, went on to say that there were only two ways of knocking the "l" out of a Pole—one, the typographical way and the other, an Irishman with a shillelagh. In this spirit, he addressed our Editor as "Mr. O'Herb." But the latter, in a communication assuring Mr. Kozlowski that the letter *l* would be restored, asserted that "'Herb' is Pennsylvania Dutch, begorra," there being a period, not an apostrophe, after the letter *O*, except on St. Patrick's Day.

Dick to Dutch

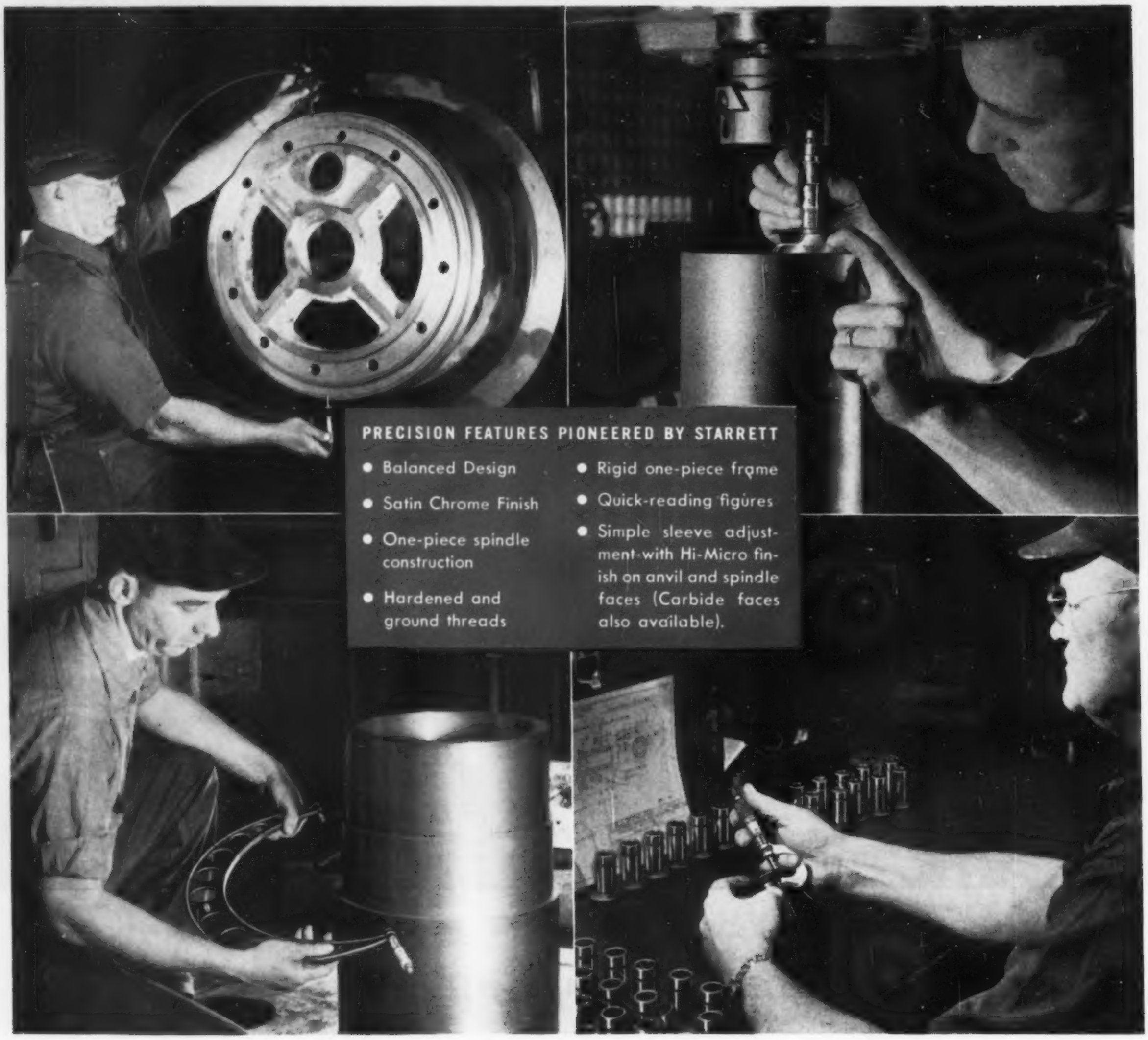
Quoting part of the letter Vice-President Nixon (Dick) wrote to J. H. Kindelberger (Dutch), chairman of the board of North American Aviation, Inc., after the epoch-making voyage of the U.S.S. Nautilus: "This feat of the Nautilus must have been a very proud and satisfying event for you and your North American associates who developed this remarkable device (the Autonetics guidance system, Ed.)."

THE SKY'S THE LIMIT, OR IS IT?—E. W. Bliss Co., Canton, Ohio, will be responsible for building and erecting this $5,000,000 radio telescope at Green Bank, W. Va., which will be operated by Associated Universities, Inc., a non-profit organization of nine eastern universities, for the National Science Foundation. The radio telescope is actually a directional receiver of radio waves so sensitive that it can pick up other radio waves transmitted from objects situated in space many times further than the largest optical telescope can see. The dish which scans the sky is 140 feet in diameter, weighs 350 tons, and at the high point in its arc towers 205 feet above the ground. The yoke which supports it contains 1202 tons of steel and ballast; the polar axis shaft weighs 780 tons. The entire weight of these and other units, over 5,000,000 pounds (dollar a pound?) will float on a film of oil. This telescope will rank as one of the world's largest precision research instruments.





STARRETT PRECISION MAKES GOOD PRODUCTS BETTER



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PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

OUNCE-INCHES OF TORQUE FOR GIVEN HORSEPOWER AND SPEED—1

R.P.M.	H.P. 1/2000	1/1500	1/1250	1/1000	1/750	1/600	1/500	1/400	1/300	1/250	1/200	1/150	1/125	1/100	1/90	1/75
	TORQUE, OUNCE-INCHES															
1	505	673	808	1010	1347	1682	2020									
2	253	337	404	505	674	841	1010									
60	8.4	11.2	13.5	16.8	22.4	28.1	33.7									
1125	.45	.60	.72	.90	1.20	1.50	1.80	2.24	2.99	3.6	4.5	6.0	7.2	9.0	10.0	12.0
1200	.42	.56	.67	.84	1.12	1.40	1.68	2.10	2.80	3.4	4.2	5.6	6.7	8.4	9.4	11.2
1300	.39	.52	.62	.78	1.04	1.30	1.56	1.94	2.59	3.1	3.9	5.2	6.2	7.8	8.6	10.4
1400	.36	.48	.58	.72	.96	1.20	1.44	1.80	2.40	2.88	3.6	4.8	5.8	7.2	8.0	9.6
1425	.36	.47	.57	.71	.94	1.18	1.42	1.77	2.36	2.84	3.6	4.7	5.7	7.1	7.9	9.4
1500	.34	.45	.54	.67	.90	1.12	1.35	1.68	2.24	2.69	3.4	4.5	5.4	6.7	7.5	9.0
1600	.32	.42	.50	.63	.84	1.05	1.26	1.58	2.10	2.52	3.2	4.2	5.0	6.3	7.0	8.4
1675	.30	.40	.48	.60	.80	1.00	1.21	1.50	2.01	2.41	3.0	4.0	4.8	6.0	6.7	8.0
1700	.30	.40	.48	.59	.79	.99	1.19	1.48	1.98	2.38	2.97	4.0	4.8	5.9	6.6	7.9
1725	.29	.39	.47	.59	.78	.98	1.17	1.46	1.95	2.34	2.93	3.9	4.7	5.9	6.5	7.8
1800	.28	.37	.45	.56	.75	.94	1.12	1.40	1.87	2.24	2.80	3.7	4.5	5.6	6.2	7.5
1900	.26	.36	.42	.53	.71	.89	1.06	1.33	1.77	2.12	2.65	3.6	4.2	5.3	5.9	7.1
2000	.25	.34	.40	.50	.67	.84	1.01	1.26	1.68	2.02	2.53	3.4	4.0	5.0	5.6	6.7
2200	.23	.31	.37	.46	.61	.76	.92	1.15	1.53	1.84	2.30	3.1	3.7	4.6	5.1	6.1
2400	.21	.28	.34	.42	.56	.70	.84	1.05	1.40	1.68	2.10	2.80	3.4	4.2	4.7	5.6
2600	.19	.26	.31	.39	.52	.65	.78	.97	1.29	1.55	1.94	2.59	3.1	3.9	4.3	5.2
2800	.18	.24	.29	.36	.48	.60	.72	.90	1.20	1.44	1.80	2.40	2.88	3.6	4.0	4.8
3000	.17	.22	.27	.34	.45	.56	.67	.84	1.12	1.35	1.68	2.24	2.69	3.4	3.7	4.5
3200	.16	.21	.25	.32	.42	.53	.63	.79	1.05	1.26	1.58	2.10	2.52	3.2	3.5	4.2
3350	.15	.20	.24	.30	.40	.50	.60	.75	1.00	1.20	1.51	2.01	2.41	3.0	3.4	4.0
3450	.15	.20	.23	.29	.39	.49	.58	.73	.98	1.17	1.46	1.95	2.34	2.93	3.3	3.9
3600	.14	.19	.22	.28	.37	.47	.56	.70	.94	1.12	1.40	1.87	2.24	2.81	3.1	3.7
3800	.13	.18	.21	.27	.35	.44	.53	.66	.88	1.06	1.33	1.77	2.12	2.66	2.95	3.5
4000	.126	.17	.20	.25	.34	.42	.50	.63	.84	1.01	1.26	1.68	2.02	2.53	2.80	3.4
4100	.123	.16	.20	.25	.33	.41	.49	.62	.82	.98	1.23	1.64	1.97	2.46	2.73	3.3
4300	.117	.16	.19	.24	.31	.39	.47	.59	.78	.94	1.17	1.57	1.88	2.35	2.61	3.1
4500	.112	.15	.18	.22	.30	.37	.45	.56	.75	.90	1.12	1.50	1.80	2.24	2.49	2.99
4600	.110	.15	.18	.22	.29	.37	.44	.55	.73	.88	1.10	1.46	1.76	2.20	2.44	2.93
4800	.105	.14	.17	.21	.28	.35	.42	.53	.70	.84	1.05	1.40	1.68	2.10	2.34	2.80
5000	.101	.13	.16	.20	.27	.34	.40	.50	.67	.81	1.01	1.35	1.62	2.02	2.24	2.69
5100	.099	.13	.16	.20	.26	.33	.40	.49	.66	.79	.99	1.32	1.58	1.98	2.20	2.64
5300	.095	.127	.15	.19	.25	.32	.38	.48	.63	.76	.95	1.27	1.52	1.91	2.12	2.54
5500	.092	.122	.15	.18	.24	.31	.37	.46	.61	.73	.92	1.22	1.47	1.84	2.04	2.45
5600	.090	.120	.14	.18	.24	.30	.36	.45	.60	.72	.90	1.20	1.44	1.80	2.00	2.40
5800	.087	.116	.14	.17	.23	.29	.35	.44	.58	.70	.87	1.16	1.39	1.74	1.94	2.32
6000	.084	.112	.13	.17	.22	.28	.34	.42	.56	.67	.84	1.12	1.35	1.68	1.87	2.25
6100	.083	.110	.13	.17	.22	.28	.33	.41	.55	.66	.83	1.10	1.32	1.66	1.84	2.21
6300	.080	.107	.128	.16	.21	.27	.32	.40	.53	.64	.80	1.07	1.28	1.60	1.78	2.14
6500	.078	.104	.124	.16	.21	.26	.31	.39	.52	.62	.78	1.04	1.24	1.56	1.73	2.07
6600	.076	.102	.122	.15	.20	.26	.31	.38	.51	.61	.76	1.02	1.22	1.53	1.70	2.04
6800	.074	.099	.119	.15	.20	.25	.30	.37	.49	.59	.74	.99	1.19	1.48	1.65	1.98
7000	.072	.096	.115	.14	.19	.24	.29	.36	.48	.58	.72	.96	1.15	1.44	1.60	1.92

Extracted from engineering-data chart compiled by the John Oster Mfg. Co., Avionic Division, Racine, Wis.

MACHINERY'S DATA SHEET

OUNCE-INCHES OF TORQUE FOR GIVEN HORSEPOWER AND SPEED—2

R.P.M.	H.P. 1/60	1/50	1/40	1/35	1/30	1/25	1/20	1/15	1/12	1/10	1/8	1/6	1/5	1/4	1/3
	TORQUE, OUNCE-INCHES														
1															
2															
60															
1125	15.0	18.0	22.4	25.7	2.99	35.9	44.9	59.8	74.8	89.8	112	150	180	224	299
1200	14.0	16.8	21.0	24.0	28.0	33.7	42.1	56.1	70.1	84.1	105	140	168	210	280
1300	13.0	15.6	19.4	22.2	25.9	31.1	38.9	51.8	64.7	77.7	97.2	130	156	194	259
1400	12.0	14.4	18.0	20.6	24.0	28.8	36.0	48.0	60.0	72.0	90.0	120	144	180	240
1425	11.8	14.2	17.7	20.2	23.6	28.4	35.5	47.3	59.0	70.8	88.6	118	142	177	236
1500	11.2	13.5	16.8	19.3	22.4	26.9	33.7	44.9	56.1	67.3	84.1	112	135	168	224
1600	10.5	12.6	15.8	18.0	21.0	25.2	31.5	42.1	52.6	63.1	78.8	105	126	158	210
1675	10.0	12.1	15.0	17.2	20.1	24.1	30.2	40.1	50.3	60.3	75.4	100	121	150	201
1700	9.9	11.9	14.8	17.0	19.8	23.8	29.7	39.6	49.5	59.4	74.3	99.0	119	148	198
1725	9.8	11.7	14.6	16.7	19.5	23.4	29.3	39.0	48.8	58.6	73.2	97.6	117	146	195
1800	9.4	11.2	14.0	16.0	18.7	22.4	28.0	37.4	46.8	56.1	70.0	93.5	112	140	161
1900	8.9	10.6	13.3	15.2	17.7	21.2	26.5	35.4	44.3	53.1	66.4	88.5	106	133	177
2000	8.4	10.1	12.6	14.4	16.8	20.2	25.3	33.6	42.1	50.5	63.2	84.2	101	126	168
2200	7.6	9.2	11.5	13.1	15.3	18.4	23.0	30.6	38.2	45.9	57.3	76.4	91.8	115	153
2400	7.0	8.4	10.5	12.0	14.0	16.8	21.0	28.0	35.0	42.1	52.6	70.1	84.1	105	140
2600	6.5	7.8	9.7	11.1	12.9	15.5	19.4	25.9	32.4	38.8	48.6	64.7	77.8	97.2	129
2800	6.0	7.2	9.0	10.3	12.0	14.4	18.0	24.0	30.0	36.0	45.0	60.0	72.0	90.0	120
3000	5.6	6.7	8.4	9.6	11.2	13.5	16.8	22.4	28.1	33.6	42.1	56.1	67.3	84.1	112
3200	5.3	6.3	7.9	9.0	10.5	12.6	15.8	21.0	26.3	31.5	39.4	52.6	63.0	78.8	105
3350	5.0	6.0	7.5	8.6	10.1	12.0	15.1	20.1	25.2	30.2	37.7	50.3	60.3	75.3	101
3450	4.9	5.8	7.3	8.4	9.8	11.7	14.6	19.5	24.4	29.3	36.6	48.8	58.5	73.1	97.7
3600	4.7	5.6	7.0	8.0	9.4	11.2	14.0	18.7	23.4	28.1	35.1	46.8	56.1	70.1	93.6
3800	4.4	5.3	6.6	7.6	8.8	10.6	13.3	17.7	22.1	26.6	33.2	44.3	53.1	66.4	88.6
4000	4.2	5.0	6.3	7.2	8.4	10.1	12.6	16.8	21.0	25.3	31.5	42.1	50.4	63.2	84.2
4100	4.1	4.9	6.2	7.0	8.2	9.8	12.3	16.4	20.5	24.6	30.8	41.1	49.3	61.6	82.1
4300	3.9	4.7	5.9	6.7	7.8	9.4	11.7	15.7	19.6	23.5	29.4	39.1	46.9	58.7	78.3
4500	3.7	4.5	5.6	6.4	7.5	9.0	11.2	15.0	18.7	22.4	28.0	37.4	44.8	56.0	74.8
4600	3.7	4.4	5.5	6.3	7.3	8.8	11.0	14.6	18.3	22.0	27.5	36.6	43.9	54.9	73.2
4800	3.5	4.2	5.3	6.0	7.0	8.4	10.5	14.0	17.5	21.0	26.3	35.1	42.0	52.6	70.2
5000	3.4	4.0	5.0	5.8	6.7	8.1	10.1	13.5	16.8	20.2	25.2	33.7	40.4	50.5	67.3
5100	3.3	4.0	4.9	5.7	6.6	7.9	9.9	13.2	16.5	19.8	24.7	33.0	39.6	49.5	66.0
5300	3.2	3.8	4.8	5.4	6.3	7.6	9.5	12.7	15.9	19.1	23.8	31.7	38.1	47.7	63.5
5500	3.1	3.7	4.6	5.2	6.1	7.3	9.2	12.2	15.3	18.4	22.9	30.6	36.7	45.9	61.2
5600	3.0	3.6	4.5	5.2	6.0	7.2	9.0	12.0	15.0	18.0	22.5	30.0	36.0	45.0	60.0
5800	2.90	3.5	4.4	5.0	5.8	7.0	8.7	11.6	14.5	17.4	21.7	29.0	34.8	43.5	58.0
6000	2.80	3.4	4.2	4.8	5.6	6.7	8.4	11.2	14.0	16.8	21.0	28.0	33.6	42.1	56.1
6100	2.76	3.3	4.1	4.7	5.5	6.6	8.3	11.0	13.8	16.6	20.7	27.6	33.1	41.4	55.2
6300	2.67	3.2	4.0	4.6	5.3	6.4	8.0	10.7	13.4	16.0	20.0	26.7	32.0	40.1	53.4
6500	2.59	3.1	3.9	4.4	5.2	6.2	7.8	10.4	13.0	15.6	19.4	25.9	31.1	38.8	51.8
6600	2.55	3.1	3.8	4.4	5.1	6.1	7.6	10.2	12.8	15.3	19.1	25.5	30.6	38.2	51.0
6800	2.47	2.97	3.7	4.2	4.9	5.9	7.4	9.9	12.4	14.8	18.6	24.7	29.7	37.1	49.5
7000	2.40	2.88	3.6	4.1	4.8	5.8	7.2	9.6	12.0	14.4	18.0	24.0	28.8	36.0	48.0

(To be continued in December MACHINERY)

Extracted from engineering-data chart compiled by the John Oster Mfg. Co., Avionic Division, Racine, Wis.

After the heaviest cuts— they disengage with a twist of the wrist

Continental Counterbores are designed so that cutting torque produces compression rather than shearing stresses. This counterbore never binds—you get quick, easy disengagement after all cutting operations. Anti-wedging action saves time and tools.

Continental Counterbores have double driving lugs on the cutters which engage double abutments in the holders, making a single powerful tool out of the cutter and holder. Double bearings, one above and one below the lugs and close to the cutting edge, guarantee rigid alignment of holder and cutter.

For more information or literature on Continental Counterbores, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit.

Continental TOOL WORKS

DIVISION OF

EX-CELL-O CORPORATION • DETROIT 32, MICHIGAN

56-61

News OF THE INDUSTRY

California, Washington and Arkansas

GARRETT SUPPLY Co., 3844 S. Santa Fe Ave., Los Angeles, Calif., has been named southern California area distributor for the Geometric Tool Division line of Equipment.

Edward C. Lindsay vice-president in charge of manufacturing, Hufford Corporation

EDWARD C. LINDSAY has been appointed vice-president in charge of manufacturing for the Hufford Corporation, El Segundo, Calif., a division of the Siegler Corporation, Chicago, Ill. Mr. Lindsay has had a wide and varied career in the automotive and machine tool industries.

FRANK J. ANDERSON has been promoted to district manager of the Seattle office of Chase Brass & Copper Co., Waterbury, Conn.

HARRISON R. MACLEOD has been appointed chief engineer of the Colson Corporation's new Jonesboro, Ark., plant.

Illinois and Indiana

PAUL N. STANTON has been named manager of the Machine Tool Division of Clearing Machine Corporation, division of U. S. Industries, Inc., Chicago, Ill.

NORBY PUTLAK has been promoted to service manager of Midland Screw Corporation, Chicago, Ill.

BERNCO ENGINEERING CORPORATION, Indianapolis, Ind., has named GEORGE W. BRUNER to the board of directors. The appointment of E. F. WINTERFELDT as plant manager has also been announced.

Michigan

The OLOFSSON CORPORATION, Lansing, Mich., recently announced new appointments as sales representatives for Olofsson Precision Boring and Special Machinery. THOR M. OLSON, Associated Machinery Sales Co., will cover the state of Michigan out of his Detroit office. Chicago will be served by HARRY A. MEYERS of Dean Machinery Co., of that city. Methods Machinery Co.'s CHARLES L. MLAKER will act as representative for Olofsson in northeast Ohio, working out of his Cleveland office. C. K. RABER of State Machinery Co., Inc., Indianapolis, will be representative for Indiana. ERNST P. EICHMAN of Ernst-Eichman Machinery Corp., Kansas City, Mo., will represent the firm in Kansas. ROBERT T. BRUNTON of G. W. Brunton & Son, Inc., will act as representative in western New York. His offices are in Buffalo. In Canada, Olofsson will be represented by A. S. POULSON of Williams and Wilson, Ltd., Toronto.

EX-CELL-O CORPORATION, Detroit, Mich., has acquired all the outstanding capital shares of a machine tool firm, Werkzeugmaschinenfabrik, Goeppingen, Wuerttemberg, Germany. The German company will operate as an independent subsidiary. Ex-Cell-O Corporation has also announced that headquarters for Bryant gages and surface plates has moved from Springfield, Vt., to the Ex-Cell-O plant in Greenville, Ohio.

OLIVER INSTRUMENT CO., INC., Adrian, Mich., has announced that it has two new distributors. Colcord-Wright Machinery & Supply Co., St. Louis, Mo., will represent Oliver in eastern Missouri and southern Illinois. Representing Oliver in the entire state of Florida will be Southeast Machinery Co., Fort Lauderdale, Fla.

JOHN T. BENNETT has been appointed sales manager of Gorham Tool Co., Detroit, Mich. Mr. Bennett has served the company in many capacities since 1940.

H. G. BIXBY, president of the Ex-Cell-O Corporation, has accepted an appointment to the board of directors of Detrex Chemical Industries, Inc., Detroit, Mich.

E. W. BLISS Co., Detroit, Mich., announces the new address of its Press and Die Supply Division—6770 East Davison Ave., that city.

BENDIX INDUSTRIAL CONTROLS SECTION, Bendix Aviation Corporation, Detroit, Mich., has announced an expansion of its Detroit plant.

New England

PRATT & WHITNEY Co., Inc., West Hartford, Conn., announces the following personnel changes: FRANK W. SCHREINER has been named district manager at the Cleveland office. ARTHUR C. DADE has been named cutting tool and gage sales manager

Frank W. Schreiner, district manager, Cleveland, Pratt & Whitney Co., Inc.

For more data on any products advertised this issue use card, page 189

for the Cleveland territory. Completion of a new precision tool warehouse and the inauguration of the new distribution operation is also announced. A 4000-square-foot building was constructed adjoining the company's Sterling Die Division plant, Cleveland, Ohio. HERBERT YANKEE, Pratt & Whitney vice-president, and manager of Sterling Die, will be in charge of the Cleveland warehouse operation. Cleveland will stock the company's products to fill the requirements of all Pratt & Whitney local stores and distributors outside of New England, eastern New York, New Jersey, and Pennsylvania.

The WALLACE BARNES DIVISION of Associated Spring Corporation, Bristol, Conn., has announced two changes in its engineering organization. JOHN B. BECKWITH has been named engineering manager. DAVID E. WAITE has been appointed to the factory manager's staff to work on special assignments.

CAPEWELL MFG. CO., Hartford, Conn., has announced the appointment of ROYAL A. WILSON as Michigan district manager. CHARLES G. MUDGE has been named sales engineer for the northern and central New Jersey and metropolitan New York area.

The LAMINATED SHIM CO., INC., Glenbrook, Conn., has elected several new officers. EDWARD B. NISBET became chairman; A. V. ANDERSON was elected president and general manager; MERLE L. LOCKWOOD advanced to executive vice-president and director of sales. Other officers elected are: RICHARD SEIPT as vice-president in charge of engineering, research, and development; OTTO HECHT as vice-president in charge of production; and HAROLD B. SWINDELLS as treasurer. Re-elected officers are FRANK P. BARRETT as vice-president and FREDERICK P. CRAIG as secretary.

HICKS CORPORATION, Hyde Park, Boston, Mass., announces the appointment of FRANK T. MAJEWSKI as executive vice-president and JOHN O. WAGNER as sales manager.

UNIVERSAL-CYCLOPS STEEL CORPORATION, Bridgeville, Pa., announces the opening of the Specialty Steel Service Center in Worcester, Mass.

TAFT-PEIRCE MFG. CO., Woonsocket, R. I., announces the addition of two agents in the Midwest and Far West. The Tool Crib, Minneapolis, Minn., has been appointed to cover Minnesota and part of Wisconsin. The House of Tools, San Carlos, Calif., will cover northern California and Nevada.

THOMAS L. CASE has joined C. I. Hayes, Inc., Cranston, R. I., as assistant to the chief engineer.

New Jersey and New York

GROOV-PIN CORPORATION, Ridgefield, N. J., has elected FELIX W. BRAENDEL president. Two other executive assignments have been announced. MRS. E. F. SCHNIEWIND was named vice-president and secretary, and F. O. BECKER was elected vice-president and treasurer of the company.

(Left) A. V. Anderson, president and general manager, Laminated Shim Co., and (right) Merle L. Lockwood, executive vice-president and director of sales, Laminated Shim Co.

WILLIAM H. ARMSTRONG has been elected vice-president and general manager of Metal Finish, Inc., Newark, N.J.

C. EUGENE MOORE was named manager of the Plainfield plant of Mack Trucks, Inc., Plainfield, N. J.

Robert S. Wright, president, USI International, division of U. S. Industries, Inc.

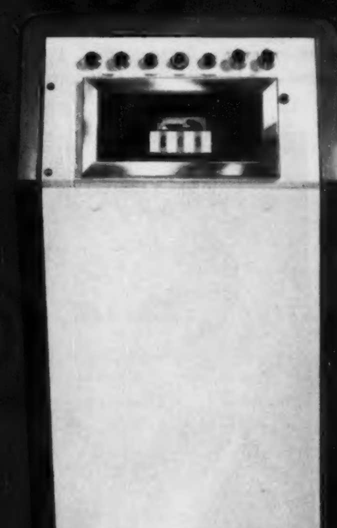
ROBERT S. WRIGHT has been named president of USI International, a division of U. S. Industries, Inc., New York City. Mr. Wright was a member of the War Production Board and has had varied experience with other firms in the field.

CARL HIRSCHMANN CO., Manhasset, N. Y., has announced the appointment of Crotts & Saunders Engineering, Inc., Winston-Salem, N. C., as sales representatives covering North and South Carolina, Virginia, and eastern Tennessee.

ROLLWAY BEARING CO., INC., Syracuse, N. Y., announces that GEORGE C. HALL has been named to succeed HARRY A. PIERCE as manager of industrial distributor sales. Mr. Pierce will continue as consultant to the Sales Department. EDWARD R. FRANCIS will succeed him as assistant general sales and advertising manager.

SHEPARD NILES CRANE & HOIST CORPORATION, Montour Falls, N. Y., has elected JOHN S. JACKSON as president. SYDNEY BUCKLEY, former president, will continue in the capacity of board chairman. HERBERT GLEDHILL will succeed Mr. Jackson as vice-president and general sales manager.

(This section continued on page 224)



AIR REDUCTION SALES CO., New York City, has announced the appointment of FRED T. WILSON as manager of its New Orleans sales office. E. C. KENNEDY succeeds Mr. Wilson as assistant manager–sales.

WALTER T. MCCOY, JR., has been named by the R. C. MAHON CO., Detroit, Mich., to be manager of its New York industrial sales organization.

OAKITE PRODUCTS, INC., New York City, has been appointed GEORGE M. SEIB vice-president. ERWIN H. STEIF will succeed Mr. Seib as secretary.

Ohio

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio, has appointed WILLIAM J. RYAN assistant general manager and assistant secretary. RALPH K. FORD, who has been Michigan district sales manager for the Heavy Machinery Division, has been promoted to plant superintendent. DON B. HOOSER has been appointed southern district manager of the Cleveland Tramrail Division of the company. He succeeds WILLIAM P. HANKS, who now is midwestern district manager.

OHIO GEAR CO., Cleveland, Ohio, has announced the appointment of three new distributors. The firms are: Bearing Supply & Service Co., Ltd., Winnipeg, Manitoba; Taccone Pneumatic Foundry Equipment Co., Erie, Pa.; and Robert J. Uplinger, Inc., Syracuse, N. Y.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., has named the W. M. Pattison Supply Co., Cleveland, Ohio, a distributor for Carmet, its carbide-producing facility. The Pattison Co. will service an area of about 100 miles radius from Cleveland.

ROBERT W. SHANECK has been named to head the sales office of Anchor Steel & Conveyor Co., Dayton, Ohio. Central and southwestern Ohio will be serviced from this office at 2801 Far Hills Ave.

LINCOLN ELECTRIC CO. (Australia) PTY. LTD., a subsidiary of the Lincoln Electric Co., Cleveland, Ohio, is building a new plant, in Sydney, Australia.

KOLCAST INDUSTRIES, a division of Thompson Products, Inc., Minerva, Ohio, has named FRED DISCHINGER, plant manager and HAROLD D. BLAKE, chief engineer.

SIDNEY MACHINE TOOL CO., Sidney, Ohio, has appointed as distributors MACHINE TOOL SALES CO., Dallas, Tex., and TRI-TEX MACHINE & TOOL CO., Houston, Tex.

C. B. HUNT & SON, INC., Salem, Ohio, announce that the company has changed its name to HUNT VALVE CO.

Pennsylvania

CARPENTER STEEL CO., Reading, Pa., has named DONALD F. ROSS and HARRY L. HIGH, JR., Ohio branch managers for Dayton and Cincinnati, respectively. The company's Alloy Tube Division, Union, N. J., has named JOHN S. KLINE assistant general manager and chief executive. P. L. CODDINGTON, who has been general manager of the Division, will continue in an advisory capacity until his retirement next year.

LANDIS TOOL CO., Waynesboro, Pa., has acquired all of the shares of stock of John Lund, Ltd., Cross Hills, nr. Keighley, England. The British company will change its name to LANDIS-LUND, LTD. Officers of the new subsidiary are M. A. HOLLENGREEN, chairman; JOHN E. HILL, managing director; and J. H. SMITH, secretary.

DISSTON DIVISION, H. K. Porter Co., Inc., Philadelphia, Pa., announces that DAVID C. CANNON has been named assistant to the general manager. ROBERT W. BRADY has been appointed district manager for the northeastern area.

WILLIAM P. YOUNGQUIST has been named assistant to vice-president–commercial of Jessop Steel Co., Washington, Pa. He also will help direct sales of its subsidiary, Green River Steel Corporation, Owensboro, Ky.

W. W. WELLBORN has been named technical director, Carbide Division, Firth Sterling Inc., Pittsburgh, Pa.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., has appointed HARDIE W. BECK general manager of its Pittsburgh plant. Mr. Beck has served the company in various capacities since 1945. He succeeds ARTHUR L. PETERSON, who is retiring after 45 years of service. JOHN A. HOUSTON has been appointed assistant general manager of the Philadelphia steel service plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill.

(Left) Donald F. Ross, manager, Dayton area of the Carpenter Steel Co., and (right) Harry L. High, manager, Cincinnati area of the Carpenter Steel Co.

Hardie W. Beck, Pittsburgh manager, Joseph T. Ryerson & Son., Inc.

EDWARD H. ELLIOTT has been appointed industrial sales representative in the Philadelphia area for Warren Pumps, Inc., Warren, Mass. His headquarters are at 419 Wyndon Road, Ambler, Pa.

JACK K. SCHULTZ has been named Philadelphia district manager of Pangborn Corporation, Hagerstown, Md. Mr. Schultz will operate out of district headquarters at 806 West Ave., Jenkintown, Pa.

E. F. HOUGHTON & Co., Philadelphia, Pa., has announced two appointments: FRANK ROSS has been named vice-president–sales and CHARLES R. SCHMITT, assistant to vice-president–sales.

NATIONAL-STANDARD Co., Niles, Mich., has acquired the operating assets of Cross Engineering Co., Carbondale, Pa., and will operate it as the Cross Perforated Metals plant.

Arthur J. Raymo, factory manager, Eddystone Division, Baldwin-Lima-Hamilton Corporation

ARTHUR J. RAYMO has been appointed factory manager of the Eddystone Division, Eddystone, Pa., Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa.

SAMUEL W. GEARHART, JR., has been promoted to chief metallurgist at Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

B. C. HAMMER is the new plant superintendent of Elizabeth Carbide Die Co., Inc., McKeesport, Pa.

GEORGE M. WHITE has been appointed plant manager of Heppenstall Co., Pittsburgh, Pa.

Wisconsin and Minnesota

WARNER ELECTRIC BRAKE & CLUTCH Co., Beloit, Wis., announces the following staff changes: EARL A. VENSTROM has been appointed metropolitan New York district manager for the Industrial Products Division of the company. Mr. Venstrom will make his headquarters at 36 Main St., Madison, N. J., ROBERT W. VIERCK has been appointed Chicago district manager for the Industrial Products Division. Mr. Vierck will make his headquarters at 6429 West North Ave., Oak Park, Ill., and will supervise the firm's sales and service activities in Illinois, Indiana, Iowa, and Nebraska.

ALLIS-CHALMERS MFG. Co., Milwaukee, Wis., has completed construction of new engineering, development and research facilities in Greendale, Wis. The new facilities include two buildings where research, scientific studies and analyses will be carried on.

DYNAMATIC DIVISION, Eaton Mfg. Co., Kenosha, Wis., announces the appointment of RALPH L. JAESCHKE as chief engineer of the Division, to succeed W. F. KING, who is retiring. Mr. King will remain on the staff as consultant on engineering matters. Mr. Jaeschke will also retain his present position as manager of research and development.

CHAIN BELT Co., Milwaukee, Wis., has announced the promotions of KENNETH P. COAN to assistant manager of the company's Chain and Transmission Division and BRUCE DEDLOW to export sales manager.

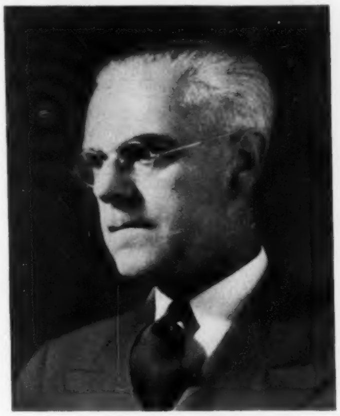
SALES SERVICE MACHINE TOOL Co., St. Paul, Minn., announces that Havir Mfg. Co., St. Paul, Minn., has acquired the "Diebel Hi-Speed" automatic presses from Di Machine Corporation, Chicago, Ill. Sales Service will distribute the presses.

Coming Event

DECEMBER 1-5—Twenty-Third Exposition of Power and Mechanical Engineering will be held at the Coliseum, New York City. For further information, contact International Exposition Co., 480 Lexington Ave., New York 17, N. Y. E. K. Stevens, manager.

Obituaries

RUSSELL M. FELLOWS, chairman of the board of directors and treasurer of the Fellows Gear Shaper Co., Springfield, Vt., died on October 13



Russell M. Fellows

at the age of sixty-six. He started work with the company in 1911 and became purchasing agent in 1916. He was elected assistant treasurer in 1932, and treasurer in 1939. In 1945, Mr. Fellows was elected a vice-president of the company. He became chairman of the board earlier this year. In addition to his executive duties he was a trustee of the Fellows Gear Shaper Employees' Trust and of the Fellows Pension Plan.

CLARENCE M. ALLEN, president of the Chas. G. Allen Co., Barre, Mass., died on September 17, in Cleveland, Ohio. He was seventy-seven. Mr. Allen was active in the machine tool field for over fifty years. He was the designer of most of the machines built by the Chas. G. Allen Co. In 1907 he became associated with the Strong, Carlisle and Hammond Co. He later became a director of the company. In 1916 he founded and was co-owner of the Hammond Mfg. Co. in Cleveland. Last May he left the Strong, Carlisle organization to join the recently formed Tri-State Machinery, Inc., distributors of Allen machine tools.

RAYMOND PAUL KELLS, aged fifty-eight, chief service engineer for Latrobe Steel Co., Latrobe, Pa., died September 10. Mr. Kells was one of the tool-steel industry's leading experts in the application and heat-treatment of high-speed steels.

New Books and Publications

GEAR RATIOS FOR 4-, 6-, and 8-GEAR COMBINATIONS, by Earle Buckingham. 95 pages, 8 1/2 by 11 inches. Published by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $5.

New, never-before-published tables of pairs of consecutive, factorable numbers from 1000 to over 40,000 are the principal feature of this book. These tables of consecutive numbers, together with their ratios and reciprocal ratios, provide a simple and direct means for putting together 4-, 6-, and 8-gear combinations to obtain specified ratios.

Part I of this book gives worked-out examples of how gear-ratio calculations are accomplished using the tables in Part II and III. Part II consists of tables of consecutive, factorable numbers from 1000 to over 40,000 together with their ratios and reciprocals of their ratios. Part III consists of Brocot's tables of gear ratios listing all ratios obtainable with any combination of two gears, each of which has 120 or less teeth. Part IV discusses important factors other than ratio, that enter into the design of gear trains. Included are considerations of relative strength of gears of the same ratio but of different size, as well as the discussion of the mountability of change gears and the use of change gears for indexing operations.

The worked-out examples in Part I illustrate ratio calculations to meet four sets of conditions: (1) no restriction on size or number of change gears; (2) number of change gears restricted but not size of gears; (3) both size and numbers of pairs restricted; and (4) finding gears for certain low and difficult ratios.

For engineers who are involved in the design of gear trains for new mechanisms, and shopmen who are figuring change gears for machine tools, this book will prove to be a valuable time- and labor-saving aid.

MACHINERY'S MATHEMATICAL TABLES. Enlarged Second Edition. Edited by Holbrook L. Horton. 254 pages, 4 1/2 by 7 inches. Published by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $3.75.

This book is an enlarged version of a book which has served readers for almost thirty years. It contains easy-to-use tables photographed directly from the pages of MACHINERY'S Handbook and places in the hands of users such as mechanical engineers, machine designers, draftsmen, toolmakers, machinists, and students authoritative, mathematical tabular information in one convenient volume. Its use has been considerably simplified by the inclusion of an edge index which permits the reader to flip quickly to a desired place in the book merely by consulting the index on the front flyleaf.

In addition to the tables of natural trigonometric functions, of logarithms, powers, roots, and reciprocals, and of circumferences and areas of circles, which were in the original edition, tables of natural logarithms, logarithms of trigonometric functions, of English and metric weights and measures, English and metric conversion tables, of geometrical propositions and constructions, and tables of dimensions, areas, and volumes of plane and solid geometrical figures have been included. Other tables of prime numbers and factors, and of radian measure have also been added.

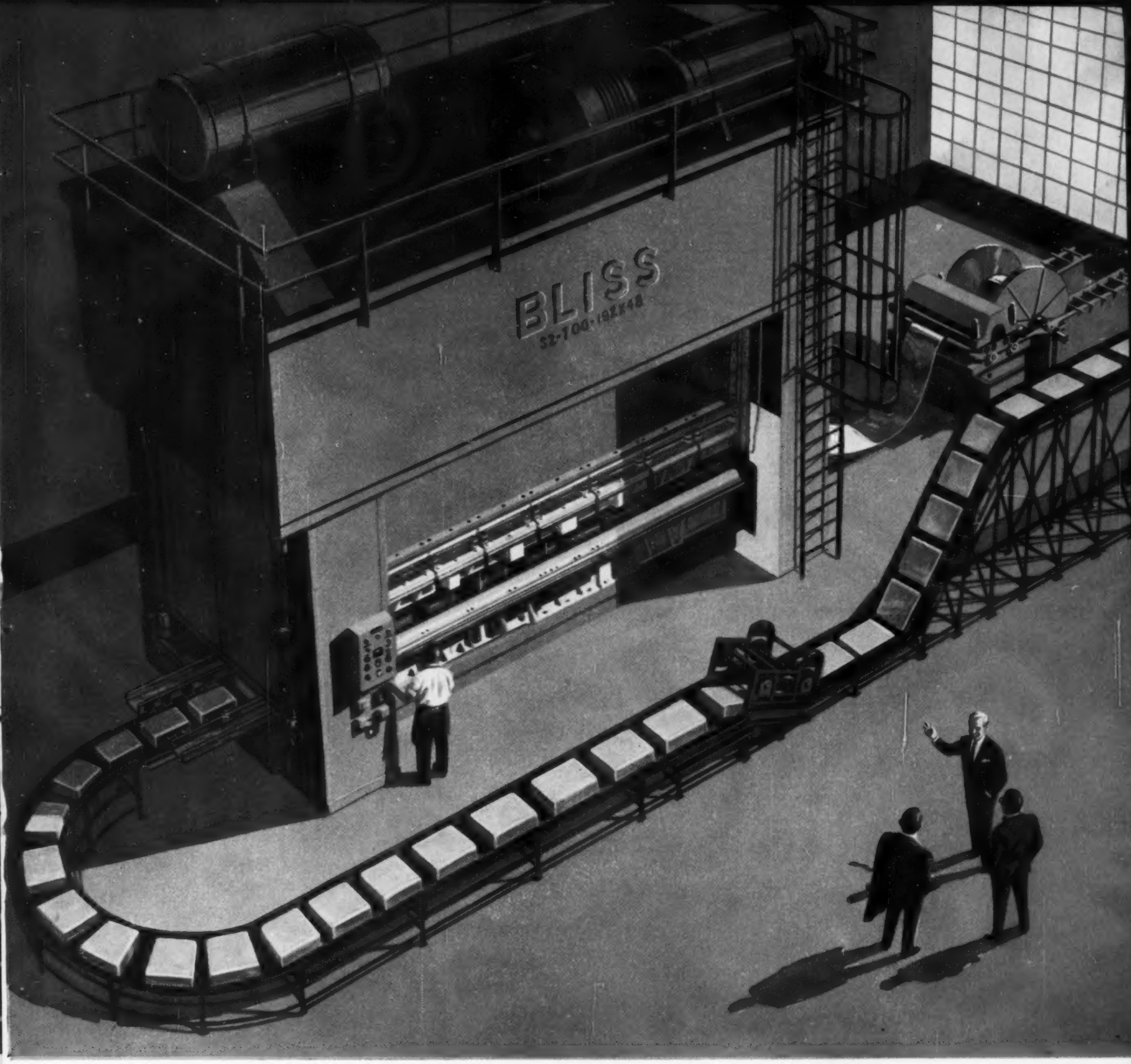
The convenient pocket size, semi-flexible covers, and thin strong pages make it a lightweight, yet durable book for everyday reference.

Tool-Holders Triple Use of Carbide Inserts

With the aid of two special Kennametal tool-holders, six cutting edges instead of two are obtained from Kendex heavy-duty parallelogram-shaped inserts used for machining rock-bit shanks in the Fort Worth, Tex., plant of the Oil Tool Division of Chicago Pneumatic Tool Co. Machining operations include taper turning of a surface to be threaded, facing of the end, and the cutting of two chamfers. The rock-bit shanks are made of three heat-treated steel forgings welded together and the rough, hard surfaces of the 40 Rockwell C molybdenum steel in the work-piece are machined by inserts made of Grade K6 Kennametal.

A standard heavy-duty Kendex tool-holder is used for turning a taper to a square shoulder. Two indexable cutting edges of the insert are used in this operation. To face the end, the insert is turned over and used in a special heavy-duty holder, thus providing two more indexable cutting edges. Since the maximum depth of cut is 3/16 inch, there is enough cutting edge remaining along the sides of the inserts to provide for the two chamfering operations, using another special tool-holder designed for chamfering.

Three tool-holders triple the usefulness of carbide inserts in the machining of these rock-bit shanks. A standard and two special tool-holders were required for turning, facing, and chamfering.


BLISS

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Norton Co., 1 New Bond St., Worcester 6. Mass.

ABRASIVES, Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie Penna.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

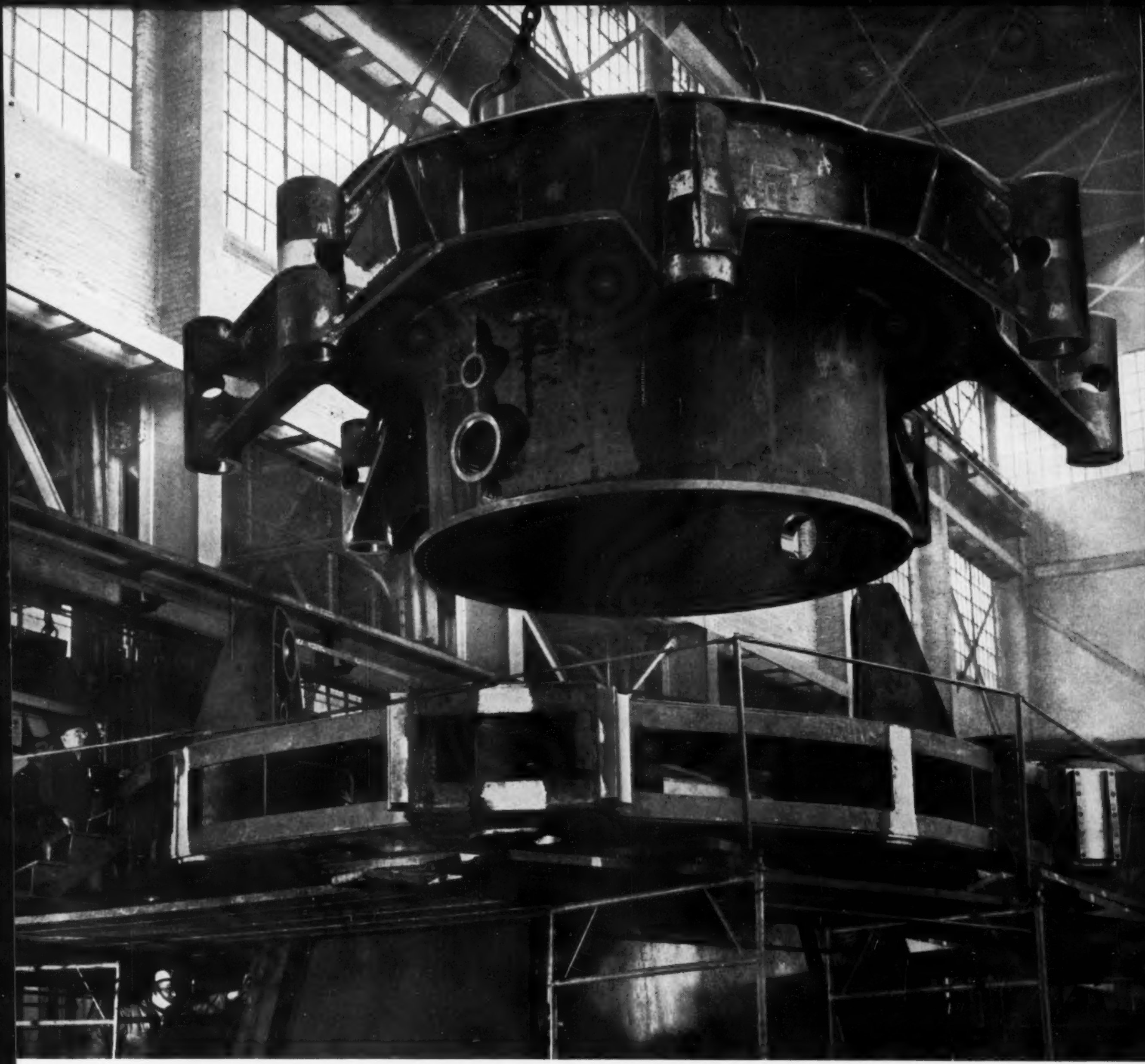
ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

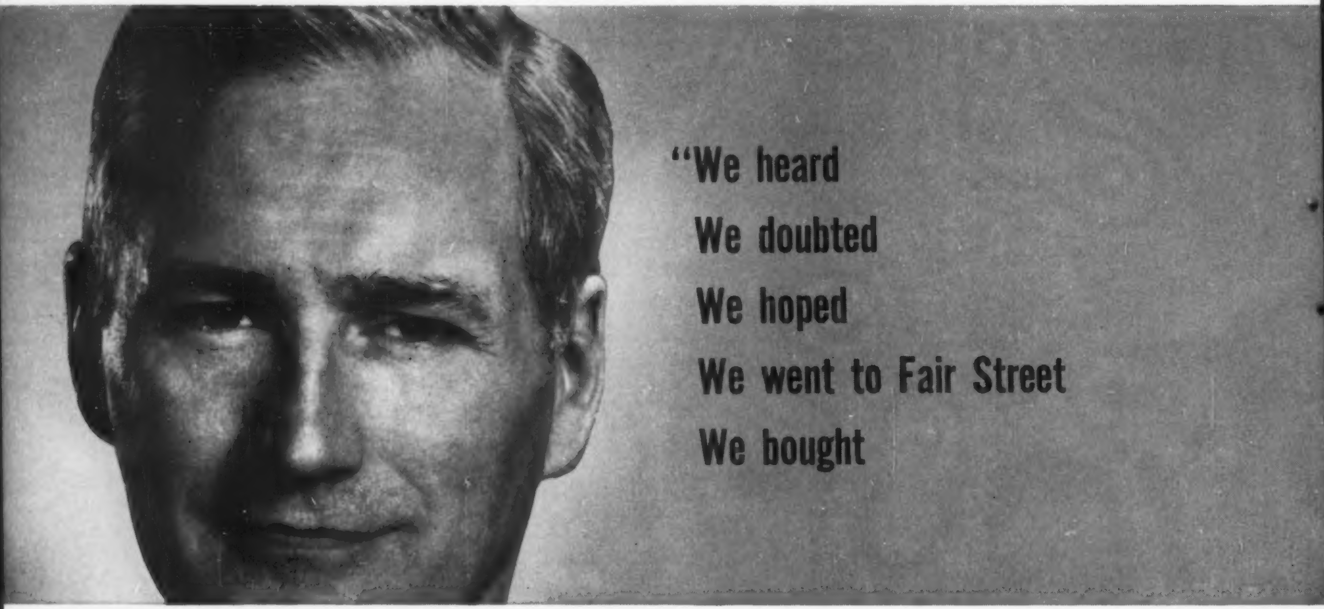
ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.



C. J. GANO, Vice-President & Plant Manager,
Speco Division, Kelsey-Hayes Co.

a man who came to Fair Street



"Two more DeVlieg JIGMILS rapidly followed the first. Continued proof of precision, speed and versatility caused us to buy an additional two machines.

With our JIGMILS we no longer use an expensive machine as a planning desk. We no longer build expensive boring fixtures. The JIGMIL Technique solves these problems and saves both time and scrap.

Our DeVlieg JIGMILS give us the versatility needed in our 'Overgrown Job Shop.' We can make prototypes with the same accuracy as tooled jobs and continue our production without expensive retooling and loss of time."

C. J. GANO

DEVLIEG MACHINE COMPANY, FAIR STREET • ROYAL OAK, MICHIGAN

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

ARC WELDERS—See Welding Equipment, Arc

ASSEMBLING MACHINES
Detroit Power Screwdriver Co., 2799 W. Fort St., Detroit 16, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Sheffield Corp., Box 893, Dayton 1, Ohio

AUTOMATIC SCREW MACHINES—See Screw Machines, Single and Multiple-Spindle Automatic

AUTOMATION EQUIPMENT
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

BABBITT
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BACTERICIDES
Lilly, Eli and Co., Indianapolis 6, Ind.

BALANCING EQUIPMENT
Balance Eng. Co., 5024 W. Lake St., Chicago 44, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALLS
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Hoover Ball & Bearing Co., Ann Arbor, Mich.

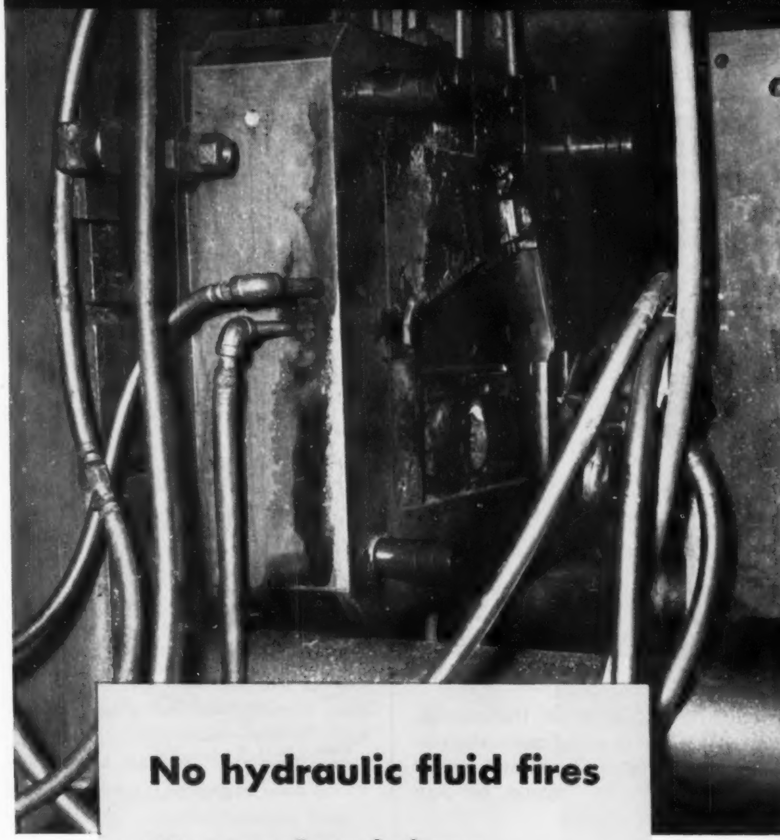
BAR MACHINES—See Screw Machines, Single and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Mueller Brass Co., Port Huron, Mich.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

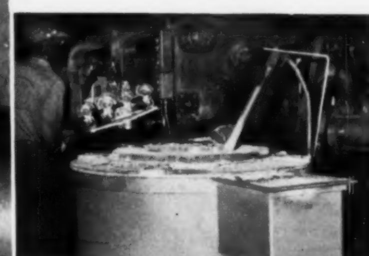
BAR STOCK AND SHAFTING, Steel
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Fafnir Bearing Co., New Britain, Conn.

"For 3 solid years—



Irus Fluid's distinctive yellow color makes it easy to spot and trace leaks.



Complexity of lines (left) and pots of molten metals (above) represent the type of fire hazards requiring Shell Irus Fluid 902.

No hydraulic fluid fires

No worker injury

No equipment damage —since we switched over to

SHELL IRUS FLUID 902"

says Ernie Ike, Plant Superintendent
Western Die Casting Co., Emeryville, Calif.

According to Mr. Ike, these results are directly due to the switch-over in 1955 from conventional hydraulic fluids to Shell Irus Fluid 902.

Irus® Fluid 902 is a special combination of petroleum oils mixed with water and emulsifying agents. Its fire resistance is achieved through the relatively high water content. Irus snuffs out fire, *under plant conditions.*

Another important advantage of Irus Fluid 902 is its low cost. Plant operators now using Irus have discovered that Irus Fluid costs up to one-third less than other fire-resistant fluids . . . yet is comparable in performance in every practical respect.

If the hydraulic equipment in your plant is exposed to fire hazards, let a Shell Industrial Representative show you the advantages of Irus Fluid 902. Write Shell Oil Company, 50 West 50th St., New York 20, N. Y. or 100 Bush St., San Francisco 6, Calif.

SHELL IRUS FLUID 902

a low-cost, fire-resistant hydraulic fluid

SHELL

For more data on any products advertised this issue use card, page 189

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Japan Bearing Export Co., Ltd., Tokyo, Japan
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio

BEARINGS, Needle
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio

BEARINGS, Oilless
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENDERS, Bar, Tube, Channel, etc.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

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  TOwnsend 8-5100
- **Los Angeles**
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  (El Segundo, California)
  ORegon 8-2503
- **Seattle**
  623 Eighth Ave., South
  MUtual 2-6950
- **Springfield (N. J.)**
  51 Springfield Ave.
  (Newark Proximity)
  DRexel 6-3500
- **Toronto**
  Vickers-Sperry of Canada, Ltd.
  92 Advance Road
  BElmont 2-1191

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8154

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

BENDERS, Plate, Etc.

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Hydraulic

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING ROLLS

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BLAST CLEANING EQUIPMENT

Pangborn Corp., Hagerstown, Md.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

BLUING LAYOUT

Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

BOLT and NUT MACHINES

Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

BOLTS, NUTS AND SCREWS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOOKS, Technical

Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS

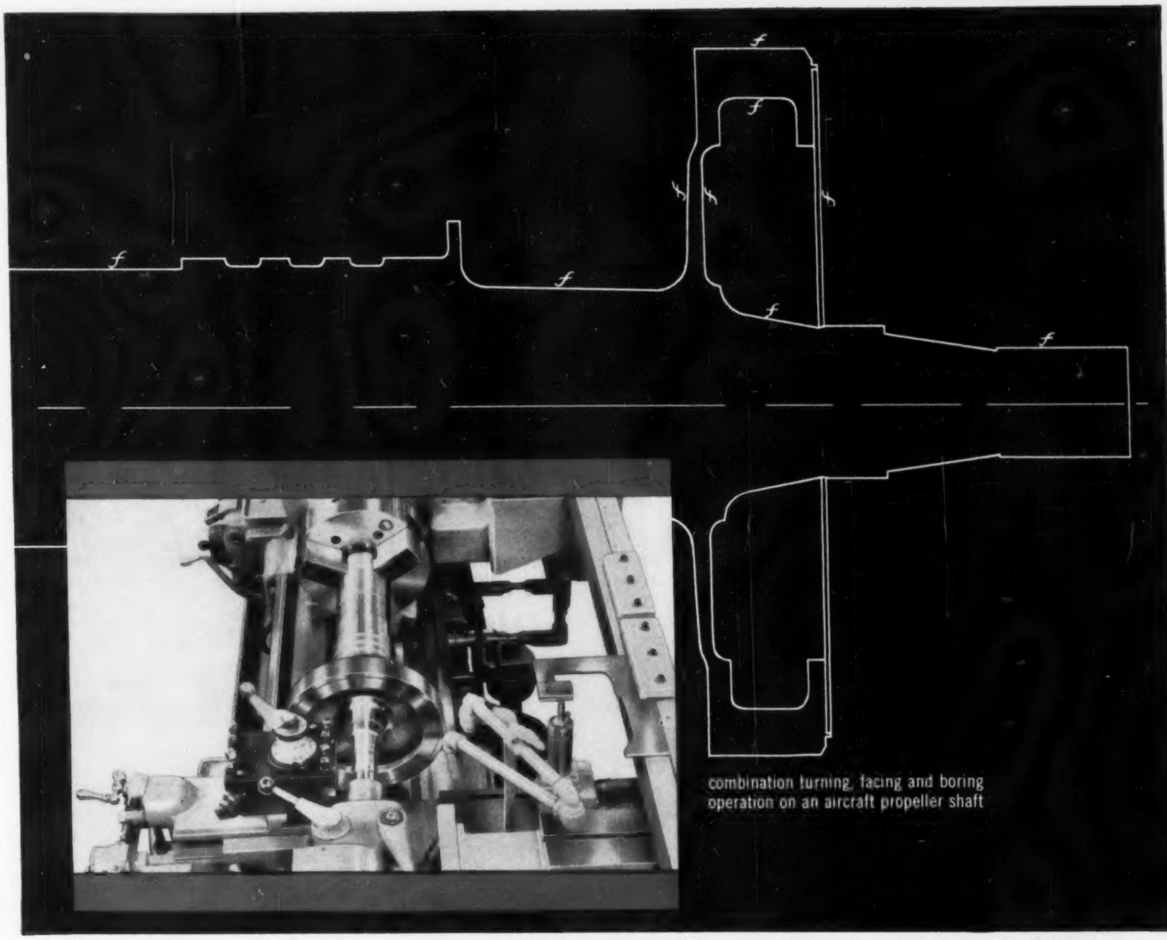
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wesson Co., 120 Woodward Heights Blvd., Detroit 20, Mich.

BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N.Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Moline Tool Co., Moline, Ill.



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New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wales-Strippit Co., Akron, N. Y.

BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BRAKES, Press and Bending

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

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American Broach & Mch. Co., Ann Arbor, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BROACHING MACHINE, Internal

American Broach & Mch. Co., Ann Arbor, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

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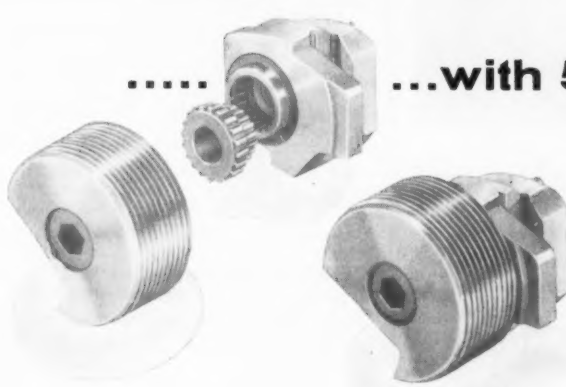

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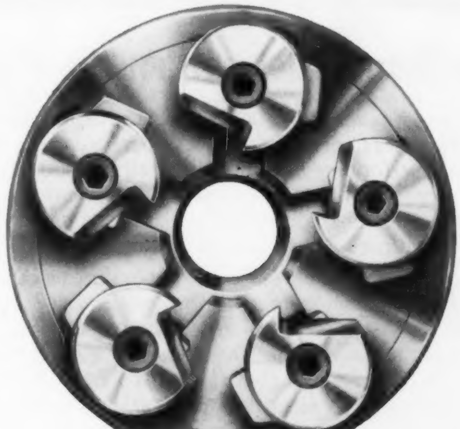

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Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

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Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

BURNISHING MACHINES
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Corbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPER, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
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Why it makes sense to upgrade your metal-cutting band saws now!

This is the best time to replace your old sawing machines because:

1. Faster Cutting Rates

Fifteen years of progress in the last five—that's what DoALL band machining now offers you! For example, DoALL's Demon® HSS Blades on new DoALL machines cut 10 times faster—and last 30 times longer than any carbon blade.

The reason: DoALL's new Contour-matics® are built far more rugged to attain greater accuracy than ever before. They employ coolant and hydraulic work feed.

The result: enormous savings in production time and labor in your shop—an entirely new concept in metalworking undreamed of with the early Model ML, which uses only carbon blades.

2. Old Machines Now Worth More

There's more value in your old DoALL now than there ever will be. In numerous cases the current market price of the obsolete Model ML equals or exceeds its original cost. Rather than give up the "old faithful," many users have found other uses for it in their own plants—for the scope and application of band saw machining has expanded greatly every year.

3. Easier Terms

Long-term purchase contracts are available for all DoALL machine tools.

A lease program, originated by DoALL, is available for those who want to take advantage of cost-saving DoALL equipment without capital expenditure.

4. Lower Costs

"Tooling for competition" requires a frank appraisal of your sawing costs. **Let us demonstrate the new performance of DoALL band machining.**

5. Productive Maintenance

Productive maintenance is your assurance of continuous profitable performance on all DoALL machines. It's a free service to DoALL users. Ask your local DoALL representative.

B-54

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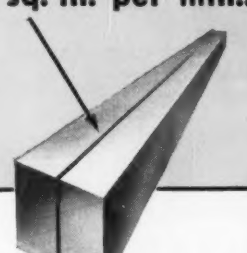
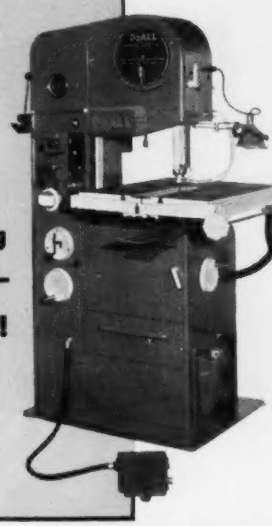
1958 MODEL 16-3 GIVES YOU . . .

592% faster sawing on 1015 mild steel—10.1 sq. in. per min.!

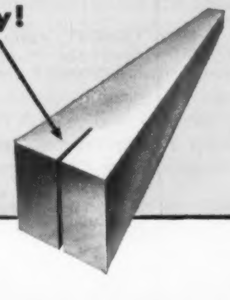


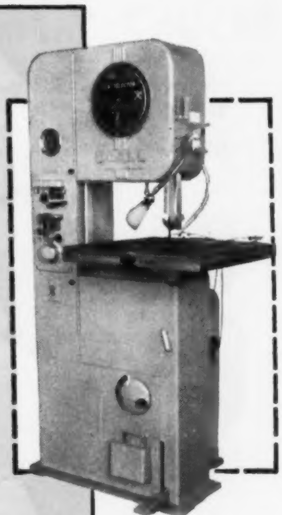


Heavy-duty Model 16-3 with coolant and hydraulic work feed, designed for Demon HSS Blade.

OBSOLETE MODEL ML GIVES YOU . . .

a cutting rate of only 1.7 sq. in. per min. —terrific in its day but unprofitably slow today!





Model ML, designed for carbon blade only.

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Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Pittsburgh Brass Mfg. Co., 3199 Penn Ave., Pittsburgh 1, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

CEMENT, Abrasive Disc
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.

CENTER-DRILLING MACHINES
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Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

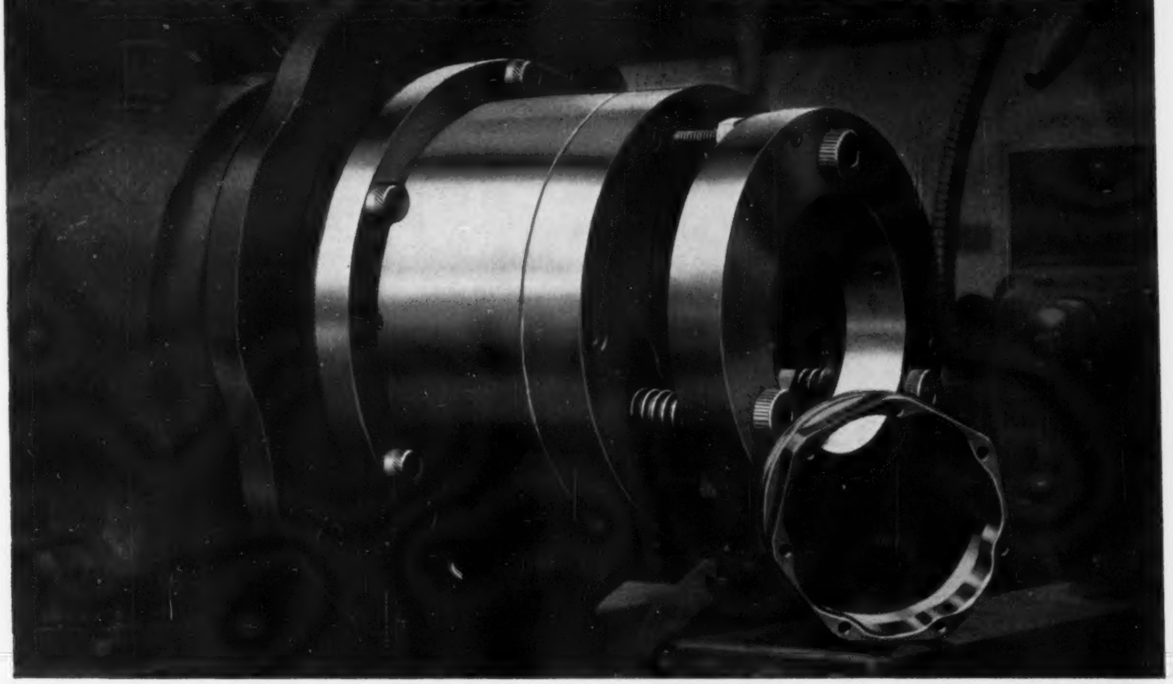
CHUCKING MACHINES, Multiple-Spindle Automatic
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter and Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

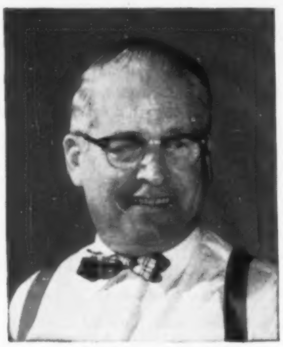
CHUCKS, Air Operated
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

WORK-HOLDING BY WOODWORTH



ROLLWAY BEARING CO. ELIMINATES DISTORTION WITH WOODWORTH "FINGER" CHUCKS



HAROLD EVANS

- **HAROLD EVANS,** *Chief Tool Engineer of Rollway Bearing Company, Inc., Syracuse, New York, commented on the excellent performance of Woodworth "Finger" Chucks: "By using the N. A. Woodworth Compensating 'Finger' Chuck, we are able to cam grind irregular shaped bearings and parts to close tolerance limits without distortion. This was one of our main problems in grinding thin-walled parts of irregular shapes. We now have solved this problem by using Woodworth Compensating 'Finger' Chucks."*

- In the above illustration, a Woodworth Standard "Finger" Chuck was altered by Rollway Bearing by replacing the three fingers with a solid ring. A segment type stop was attached to the face of the cylinder housing. The work piece is inserted behind the retaining ring and located against the stop with a spring loaded plunger. When the air is turned off, the part is face clamped firmly. In this operation on a converted Heald No. 70 A, a cam bearing inner race with seven lobes is ground to 2.7500-2.7510 diameter with a 10 to 15 micro-finish. The chuck spindle speed is 10 R.P.M. and the wheel spindle 12,500 R.P.M. Concentricity of the outer race to the inner lobe race is held to $\pm.0005$. The cam on the spindle and chuck reproduces the desired 7-lobe contour when parts are end clamped with the solid clamping ring.

- Woodworth's "Finger" Chuck compensates for irregular shapes of surfaces and allows distortion-free chucking of frail cross-section parts.

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Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill, Key Type
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Full Floating
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

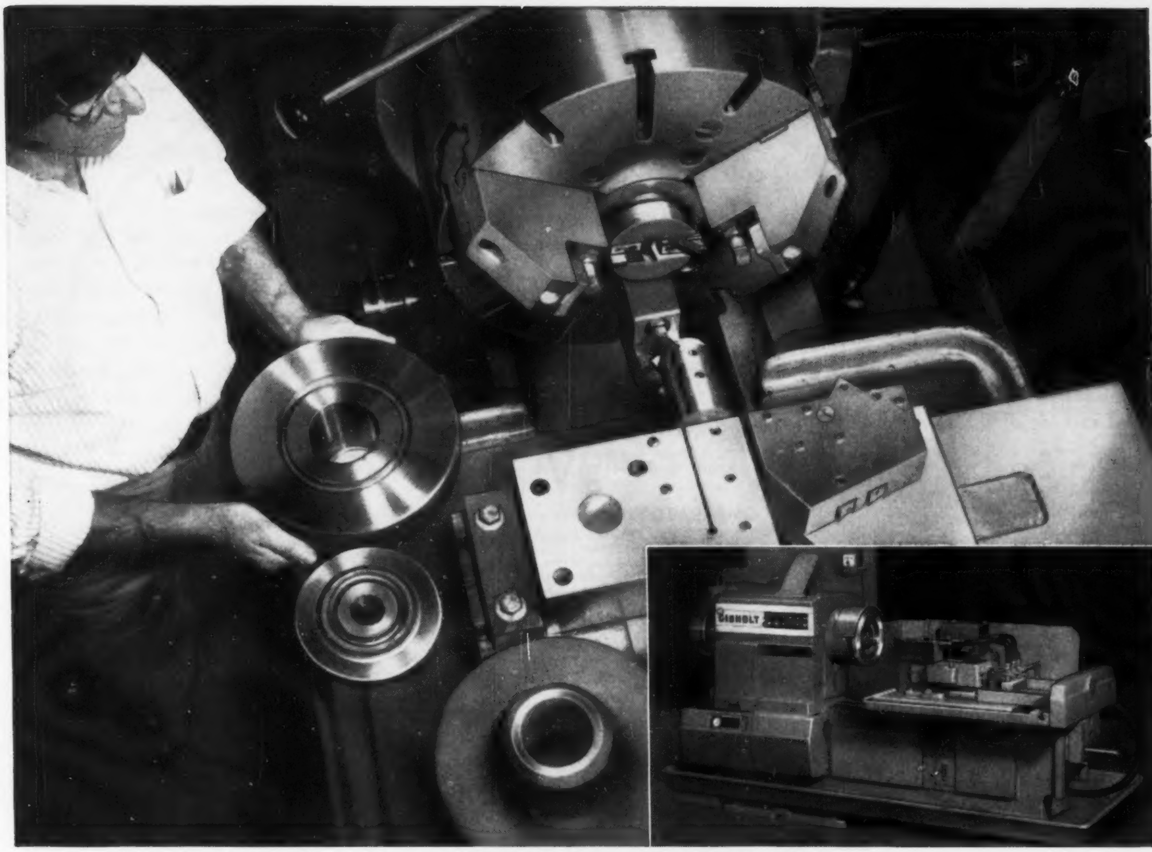
CHUCKS, Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Walker, O. S. Inc., Worcester, Mass.

CHUCKS, Power Operated
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
Jacobs Mfg. Co., West Hartford 10, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.



Smart planning on Simplimatic holds f.t.f. time to 1.7 min. on 6½" diam., 3.3 min. on 10¾" diam. workpieces.

How OTM Corp. cuts costs machining parts in 13 sizes

Handles each part in single chucking, using Simplimatic with back-facing attachments and two-speed motor

You may get ideas from the way OTM Corporation, Houston, Texas, machines steel welding neck flanges and welding necks—with each part in 13 different sizes—completing each part in a single chucking and holding change-over time to an absolute minimum.

Here's how the job is done on a Gisholt Simplimatic Automatic Lathe: Facing, grooving, boring and chamfering operations are performed from tools on short tool slides, with T-slotted tops for quick adjustment. Relieving the boring tool at the end of the cut eliminates tool tracks. Simultaneously, a special back-facing attachment works through the spindle to shave-face and chamfer the O.D. on the hub. A power chuck wrench operates the scroll chuck and permits mounting this attachment in the spindle bore. A two-speed motor provides correct surface speed and permits switching from high speed (for turning and facing) to low speed (for grooving operation) and back again, during the Simplimatic's automatic machining cycle.

Here, again, the Gisholt MASTERLINE Simplimatic Automatic Lathe saves a manufacturer the cost of a special machine. Its extra wide platen table provides ample space for an infinite number of slide and tool arrangements—and its table feed permits tools to engage with the work or perform additional machining operations before actual slide movements begin. Ask your Gisholt Representative to show you how the Simplimatic performs special machine functions at standard machine prices—on your product and under your production conditions.

MASTERLINE GISHOLT SINCE 1887

GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

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For more data on any products advertised this issue use card, page 189

CHUCKS, Ring Wheel
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

CHUCKS, Universal Three-Jaw
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Oakite Products, Inc., 26 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works, Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Conway Clutch Co., 2747 Colerain Ave., Cincinnati 25, Ohio
Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Minster Mch. Co., Minster, Ohio.

COLD HEADING
Hassall, John, Inc., Westbury, L. I., N. Y.
National Machinery Co., Tiffin, Ohio

COLLETS—See Chucks, Collet

COLLOIDAL GRAPHITE
Acheson Colloids Co., 2150 Washington Ave., Port Huron, Mich.

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 883, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., 54 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Van Keuren Co., Watertown, Mass.

CONTROLLERS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.

CONTROL SHAFTS—See Lead-screws & Splines, Ball Bearing

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes, W. F. & John Co., Rockford, Ill.

COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

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Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

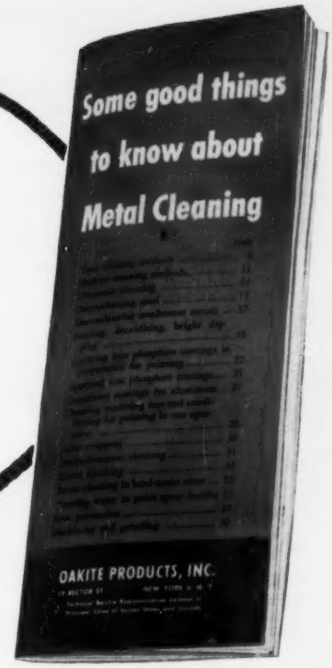
COUNTERS
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CUTTERS, Keyseating
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
DoAll Co., Des Plaines, Ill.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Tw'st Drill & Tl. Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

WHICH METAL-CLEANING JOBS WOULD YOU LIKE TO IMPROVE?



¶ Are you cleaning metal in the most economical way? *See page 9 of Oakite's FREE booklet on Metal Cleaning.*

¶ Are you cleaning metal the fastest way? *See page 12.*

¶ Do you need room-temperature cleaning combined in one operation with temporary rustproofing? *See pages 12 and 14.*

¶ Do you know the advantages of *alkaline* pickling? *See page 21.*

¶ Have you compared the values of iron phosphate coating and zinc phosphate coating in preparation for painting? *See pages 22 and 25.*

¶ Can you use a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 30.*

¶ Do you have trouble stripping epoxy resins, pigment residues, phosphate coatings and under-paint rust? *See page 31.*

¶ How do you clean parts that are too large to be soaked in tanks or sprayed in machines? *See page 31.*

¶ Are you getting full profit out of your finishing barrels? *See page 32.*

¶ What do you do when oversprayed paint neither floats nor sinks in your paint spray booth wash water? *See page 35.*

¶ Do you need better protection against rusting in process or in storage? *See page 37.*

Here is the full table of contents of Oakite's 44-page illustrated booklet called "*Some good things to know about Metal Cleaning*".

Tank cleaning methods
Machine cleaning methods
Ultrasonic cleaning
Electrocleaning steel
Electrocleaning nonferrous metals
Pickling, deoxidizing, bright dipping
Applying iron phosphate coatings in preparation for painting
Applying zinc phosphate coatings
Conversion coatings for aluminum and zinc
Cleaning, removing rust and conditioning for painting in one operation
Paint stripping
Steam-detergent cleaning
Barrel finishing
Better cleaning in hard-water areas
Treating water in paint spray booths
Rust prevention
Machining and grinding

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Export Division Cable Address: Oakite

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CUTTERS, Milling

Apex Tool & Cutter Co., Inc., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Tool Co., 11200 Madison Ave., Cleveland 2, Ohio.
National Twist Drill Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type

Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Cone Automatic Mch. Co., Windsor, Vt.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

Delta Power Tool Div., 400 N. Lexington Ave. Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co. 1 New Bond St., Worcester 6, Mass.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Lufkin Rule Co., Saginaw, Mich.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit Co., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y

DIES, Lettering and Embossing
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

DISINTEGRATORS
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

DOWEL PINS
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
DoAll Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

DRAWING COMPOUNDS
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

DRESSERS, Grinding Wheel
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DRIFT KEYS
DoAll Co., Des Plaines, Ill.

DRILL HEADS, Multiple Spindle
Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Delta Power Tool Div., 400 N. Lexington Ave., Milwaukee 10, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

(Continued on page 252)

Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois

DRILL SLEEVES AND EXTENSION HOLDERS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Automatic Tool Co., Richmond, Ind.
National Twist Drill & Tool Co., Rochester, Mich.

DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

DRILLING AND BORING UNITS, Self-contained

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
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Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
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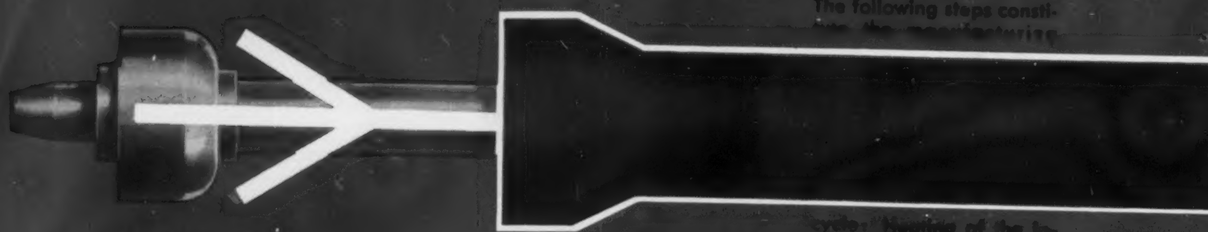
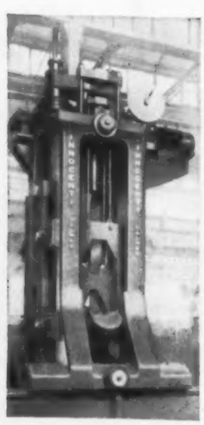


The "INNOCENTI-Calmes" pilger mill is suitable to manufacture seamless pipes up to an 18" diameter. The following steps constitute the manufacturing cycle: Heating of the ingots at the rotating furnace, piercing at piercing press (1) and preliminary rolling at the elongator-equalizer mill (2) in order to center the hole of the ingot and to improve the metallurgical qualities of the steel. The final rolling at the pilger mill (3) (4) (5) is obtained by forging and

Pilger mill and expanding installation for

INNOCENTI



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Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.

DRILLING MACHINES, Deep Hole

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
LeMaire Tool & Mfg. Co., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit Corp., Akron, N. Y.

DRILLS, Center

Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

DRILLS, Deep Hole, Gun

Ace Drill Corp., Adrian, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Oil Hole, Oil Tube

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Portable pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DRILLS, Subland

Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 49th St. Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tl. Co., Rochester, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel

Ace Drill Corp., Adrian, Mich.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Twist, Carbide, Carbide-Tipped

Ace Drill Corp., Adrian, Mich.
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

ELECTRICAL DISCHARGE MACHINES —See Disintegrators

ELECTRONIC CONTROL SYSTEMS

Electronic Control Systems, 2231 S. Barrington Ave., Los Angeles 64, Calif.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXPANDERS, Mechanical, Hydraulic

Grotnes Machine Wks., Inc., 5454 N. Walcott, Chicago 40, Illinois

EXTRACTORS, Screw

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

FACING HEADS

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div. Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FASTENERS

Allen Mfg Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.

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Ordinary spring and Strippit Hydra-Spring of equivalent force.

equal stripping power in 1/6 the space

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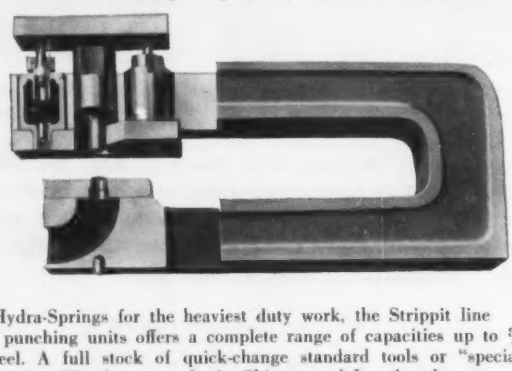

Using Hydra-Springs for the heaviest duty work, the Strippit line of hole punching units offers a complete range of capacities up to ¾" in mild steel. A full stock of quick-change standard tools or "specials" made to your order. Warehouse stocks in Chicago and Los Angeles.

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Hassall, John Inc., Westbury, L. I., N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

FEEDERS, Automatic

Gear-O-Motion Div., Michigan Tool Co., 7171 McNichols Rd., Detroit 12, Mich.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
V & O Press Co., Hudson, New York

FILES, Band

DoAll Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern

DoAll Co., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary

DoAll Co., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES

Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FLAME-HARDENING MACHINES

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

FORGING MACHINES, Headers, Upsetters, Presses

Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

FORGING, Hollow-Bored

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.

FORGINGS, Drop

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Wyman-Gordon Co., Worcester, Mass.

FORGINGS, Press

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)

FORGINGS, Upset

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.

FORMING MACHINES, Cold-Rolling

(Continued on page 262)

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima- Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

FORMING TOOLS or Tool Blanks

Brown & Sharpe Mfg. Co., Providence, R. I.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

GAGE BLOCKS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding

Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper Telescoping Thickness

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Multiple Inspection

Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett, The L. S., Co., Athol, Mass.

GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Bevel and Spiral

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS

American Schiess Corp., 1232 Penn. Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

GEAR LAPPERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.

GEAR MOTORS—See Speed Reducers

GEAR RACKS

Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS

Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Non-metallic

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

GEARS, Cut

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefedorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio

(Continued on page 264)

Horsburgh & Scott Co., 5114 Hamilton Ave., Cleveland 14, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

GENERATORS, Electric

Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Carbide Tool

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

GRINDERS, Die and Mold

Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee, Adrian, Mich. (also drill point thinner)
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill

Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio

GRINDERS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.

GRINDERS, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDERS, Tool and Cutter

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co. 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost

Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, 8. Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W. Grand Rapids 2, Mich.
National Broach & Mch. Co. 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam

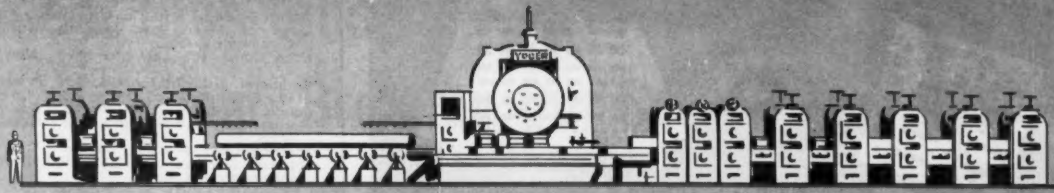
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GRINDING MACHINES, Centerless

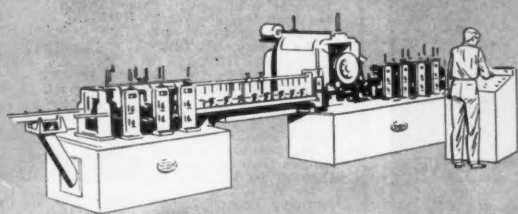
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

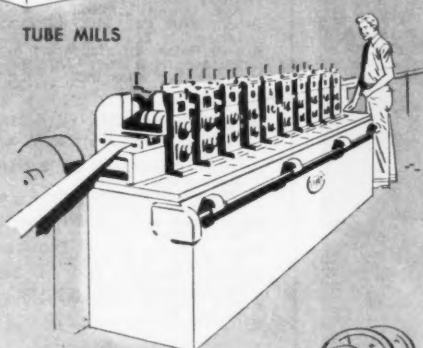
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.



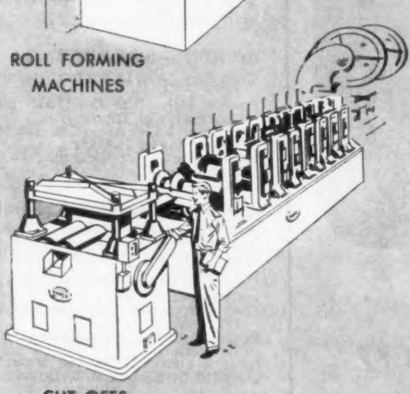
PIPE MILLS



TUBE MILLS



ROLL FORMING MACHINES



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...Complete equipment lines for heavy or light production!

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Special attachments and auxiliary units can perform additional operations such as welding, coiling, punching or embossing without extra labor cost while increasing production speed.

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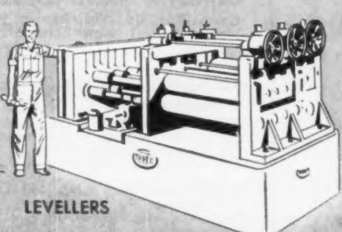
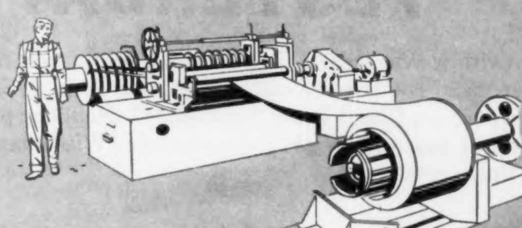


LEVELLERS



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ENGINEERING
YODER
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PIPE AND TUBE MILLS (ferrous or non-ferrous)

COLD ROLL FORMING MACHINES

ROTARY SLITTING LINES

For more data on any products advertised this issue use card, page 189

GRINDING MACHINES, Cylindrical

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDING MACHINES, Disc

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

American Laubscher Corp., Fisk Bldg., 250 W. 57 St., New York 19, N. Y.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

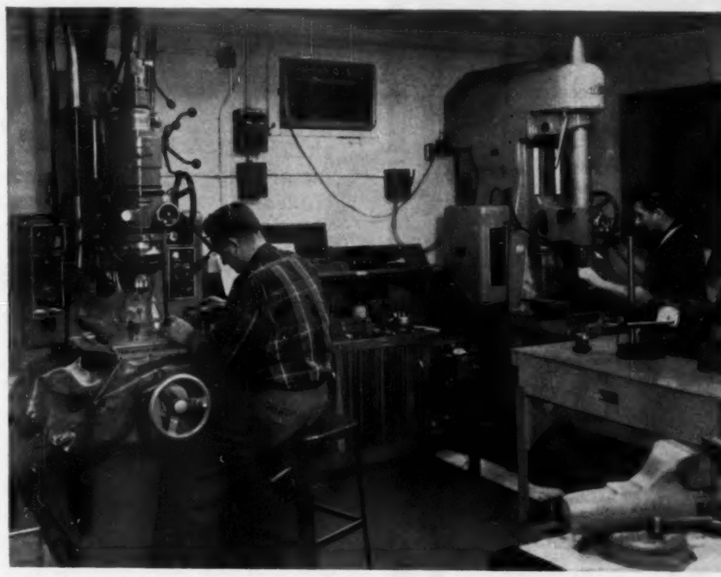
GRINDING MACHINES, Surface Reciprocating

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

Ernest Olds tells how Moore Jig Borer and Jig Grinder Help "Broaden Our Scope of Precision"

This is another in a series featuring the views of leading tool and die companies

by **ERNEST E. OLDS,** General Sales Manager
Size Control Company, Chicago, Illinois
Manufacturers of gages and lapping machines



MOORE JIG GRINDER (left) and Moore Jig Borer team up in this dust-free temperature controlled room at Size Control Company. Under such conditions they have held hole location tolerances to .00005".

"We at Size Control Company find it absolutely necessary to broaden our scope of precision to meet the increasing needs of our customers. This calls for holding close limits on location as well as our usual tolerances on diameters.

"The Moore Jig Borer and Jig Grinder is our answer! In use, these machines give amazing, practical flexibility to establish extreme accuracy with repeated confidence.

"The Moore Jig Borers and Jig Grinders which we are now using are in a special temperature controlled room. They have held tolerances as close as .00005" with comparative ease. They are used in conjunction with electronic gages, which re-inspect the results of the Borer and Grinder and act as a double-check for accuracy."

In addition to maintaining close tolerances for tooling accuracy, Moore Jig Borers are designed for economical, high-precision production operations. Moore Jig Grinders prove their mettle in the finish-grinding of intricate contour shapes and holes. For literature describing the unique features of both these toolroom time- and cost-cutters, just write...

MOORE SPECIAL TOOL COMPANY, INC.
734 Union Avenue, Bridgeport 7, Connecticut

HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. $5 in U. S. A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

GRINDING MACHINES, Surface Rotary

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Walker, O. S. Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Majestic, Inc., 147 Joseph Campau, Detroit, Mich.

GRINDING WHEEL DRESSING AND FORMING DEVICES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Bay State Abrasive Co., Westboro, Mass.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Edlund Mchry. Co. Div., Cortland, N. Y.

(Continued on page 272)

An expert in check-out helped us check up

This test pilot of ours has checked out every new design we've had in the last two years. His business is finding answers to questions. But last week he asked *us* one.

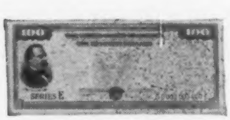
"Why can't we rig it so I can buy U. S. Savings Bonds out of my salary, automatically?" he asked. "I want to save, but I keep forgetting about it."

We told him, of course, that we've had Payroll Savings for years. Within minutes his card was signed and he was brought into the Plan. Then we decided to check up and see how many other people on our staff had never heard about the Plan. There were quite a few.

A telephone call to our State Savings Bond Director was all we needed. He supplied us with the latest booklets, folders and forms. Then he conducted a survey straight through our company and put an application blank in the hands of every single employee.

There wasn't a bit of pressure about this information campaign, but the way our people responded was inspiring. They proved that the average American wants the fine investment security that U. S. Savings Bonds provide.

Today there are more Payroll savers than ever before in peacetime. Your State Director will be happy to help you install a Payroll Savings Plan or build enrollment in one already existing. Look him up in the phone book or write: Savings Bonds Division, U. S. Treasury Dept., Washington, D. C.



MACHINERY

Erie Foundry Co., 1253 W. 12th St., Erie Penna.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

HARDNESS TESTERS

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.

HEAT-TREATING EQUIPMENT — See Annealing Furnaces, Flame Hardening Machines, Induction-Heating Equipment

HOBS

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HOISTS, Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HONING MACHINES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-120th St., Moline, Ill.

HONING STONES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Jes-Cal Co., Fraser, Michigan
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HOSE

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

HYDRAULIC MACHINERY
Tools and equipment

Baldwin-Lima Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING and SPACING EQUIPMENT

Austin Industrial Corp., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool C., 2531 11th St., Rockford, Ill.
Vinco Corp., 9111 Schaefer Highway, Detroit, Mich.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, L. S. Co., Athol, Mass.

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The, L. S., Co., Athol, Mass.

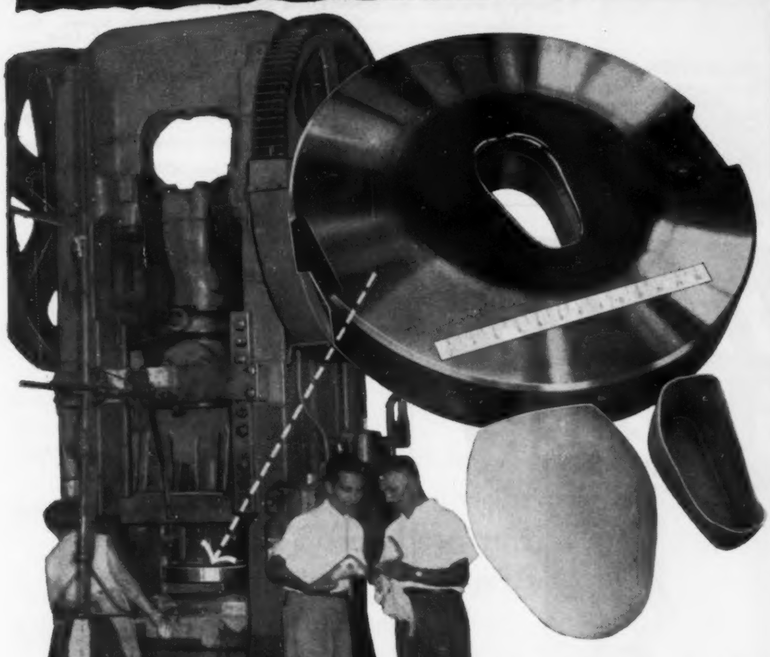
INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.

TALIDE DIE SAVES OVER $20,000 DRAWING AUTO BUMPER GUARDS



● Oakman Manufacturing Company, large Detroit stamping firm, found it difficult to deep draw steel bumper guards. Complex bends, up to 120 degrees, produced extra stress and strain on the $1800 chrome-plated drawing die.

It was necessary to stone the die surface every hour, and hand polish entire drawing surface after each day's run. The steel die had to be completely reworked and a new chrome-plated surface added after drawing 60,000 parts. Downtime for maintenance made it difficult to maintain production schedules. Maintenance costs soared.

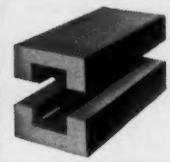
A Grade C-80 Talide die ($2700) was installed 8 months ago. To date it has drawn over 800,000 guards with no wear in evidence. Downtime for die maintenance has been greatly reduced. A buffing operation (25c per piece), previously required, has been entirely eliminated because of the smoother, brighter, more durable finish achieved with the Talide die.

A Talide die engineer can help you cut costs and increase production on draw presses, punch presses, pill presses, cold headers, swagers and draw benches. **METAL CARBIDES CORPORATION, 6001 SOUTHERN BLVD., YOUNGSTOWN 12, OHIO.**

Send for 76-Page Catalog 56-G

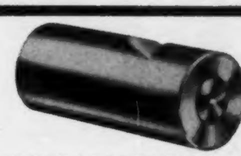
METAL CARBIDES CORPORATION
MC
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY



SWAGING DIES

Leading Fountain Pen Manufacturer cold swages 33 times more stainless steel parts with TALIDE dies.

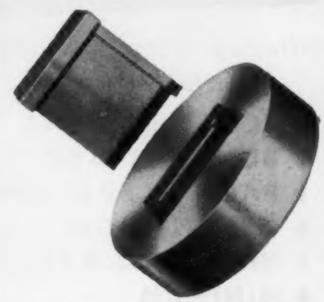


HEADING AND EXTRUSION DIES

Cold heading ¼" C-1008 rivets, TALIDE dies produced 11,200,000 pieces, other carbide dies only 3,500,000.

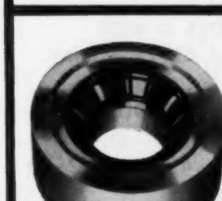
CURLING ROLLERS

TALIDE Curling Rolls last 65 times longer than steel rolls on beverage can forming operation.



BLANKING AND FORMING DIES

70 times more paper discs blanked out with TALIDE—over hard alloy die.

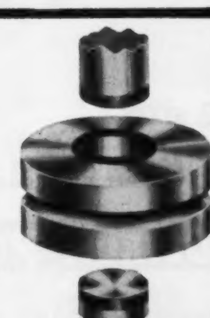


SHEET METAL DIES

137,000 hi-alloy steel pressure vessels drawn with TALIDE against only 7,900 with steel dies previously used.

POWDERED METALLURGY DIES

Compacting highly abrasive chemical powders, TALIDE pill dies last 4 months, steel dies wore out in 6 hours.



JACKS, Planer—See Set-up Equipment

JIG BORERS

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

JIG and FIXTURE PARTS

Northwestern Tools, Inc., 117 Hollier Ave., Dayton 3, Ohio

JIGS AND FIXTURES

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Metal Carbides Corp., Youngstown 12, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

LAPPING MACHINES

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Do-All Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.

LATHE ATTACHMENTS

Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Car Wheel

Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating — See Lathes, Duplicating

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

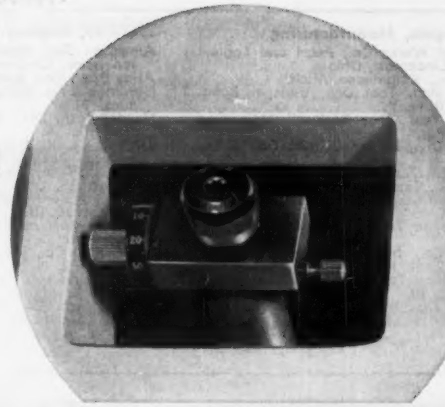
LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

LATHES, Duplicating

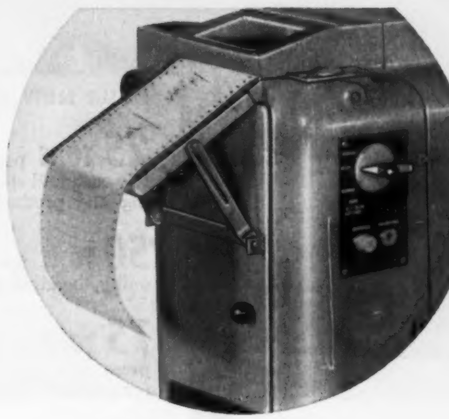
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

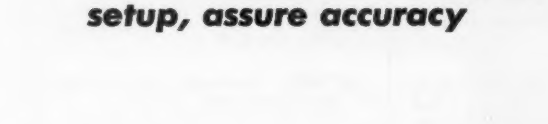
A 56x macroscope with graduated eyepiece (image appears right side up and unreversed) provides the precision reference against which the sine-bar plate (controlling table movement) is located. No special operating skill is required.



Now— an <u>EASY</u> way to check gear lead

Michigan's new Precision Lead-Measuring Instrument uses built-in optical system, recording device to simplify setup, assure accuracy





Bulletin 1218A details the unit. Send for it.

Cuts your set-up time 25 to 50% . . . calculations are virtually eliminated . . . checks leads from zero to infinity to tenths on external and internal helical and spur gears. Also checks herringbones and worms. Instead of gage blocks, micrometers, verniers, etc., you merely line up cross-hairs through a direct-reading, built-in optical system. The sine-bar controlled instrument is manually operated . . . exact-angle locking is positive. Now, you're checking gear leads—fast, accurately and economically. Other 1218A features: an integral data recorder for permanent reference; an electronic gaging head; capacity to 18-inches gear diameter; and Michigan Tool construction.

MICHIGAN TOOL Company

7171 E. McNICHOLS RD., DETROIT 12, MICH., U.S.A.
IN CANADA: COLONIAL TOOL CO. LTD.

For more data on any products advertised this issue use card, page 189

LATHES, Engine, Manufacturing

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Engine, Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
Leblond, R. K. Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Logan Enginering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

LATHES, Gap

Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

LATHES, Hollow Spindle

LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

LATHES, Speed, Second-operation

Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type

Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

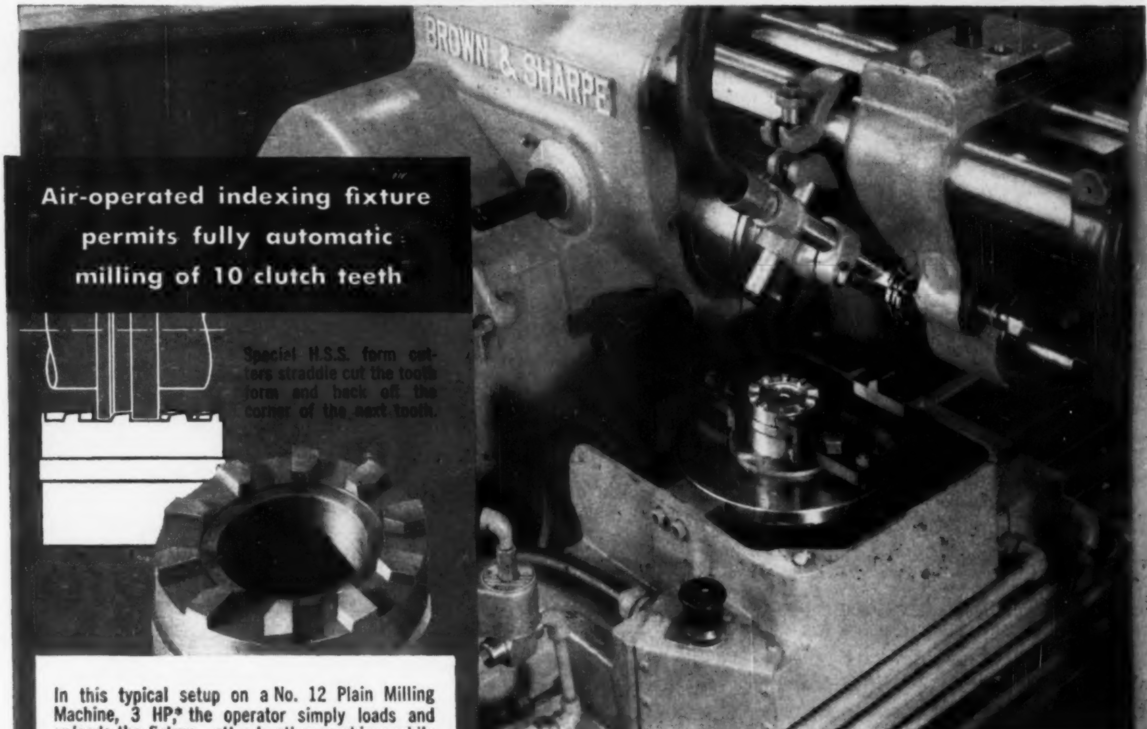
LATHES, Turret Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Co., Athol, Mass.

The BROWN & SHARPE No. 12 delivers

SPECIAL machine productivity with STANDARD machine economy



In this typical setup on a No. 12 Plain Milling Machine, 3 HP,* the operator simply loads and unloads the fixture—attends other machines while indexing and cutting are completed automatically.

An air operated clamp, which holds the index table securely while the cut is being made, is released just before indexing. This clamp is also engaged manually, to prevent the work spindle from rotating, while loading or unloading the work.

The automatic cycle begins with advance of table in fast travel (300″ per min.). During this traverse, three micro-switches, contacted by special table dogs, activate the following: (1) the index cylinder is retracted to be ready for the next index, (2) a locking plunger positively positions the index plate, (3) the work spindle is clamped securely. The cutting feed is engaged automatically and, on completion of the cut, the table returns in fast travel. During this traverse, the micro-switches are activated in reverse order — unclamp, unlock, index.

This cycle repeats automatically until all teeth are cut. On the last index, an internal end-of-cycle switch is contacted, and after the last cut the table returns and stops for reloading.

By adjusting the stroke of the indexing cylinder and changing the index plate, different numbers of teeth can be cut, as required.

Part **Reversing clutch** *Material* **High carbon steel**
Cutter speed **220 RPM** *Feed rate* **7″ per min.**
Gross production **18 PIECES PER HOUR**
Former production **10 pieces per hour**

* Also available in 7½ and 10 HP spindle drive.

– more production per dollar invested

The operating features you need for fully automatic milling are *standard* in the Brown & Sharpe No. 12 Plain Milling Machine. By adding fixtures of special design, at relatively moderate cost, you can match the productivity of expensive single-purpose special machines.

Your equipment investment is lower, and you retain the unlimited adaptability of the basic No. 12 machine. It can be easily converted for revised operations, or to other jobs.

Brown & Sharpe specialists in fixture design will survey your operations and make recommendations at your request. Let them show you how to make your investment in production milling equipment pay the highest return in savings. For complete information, write: Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

PROGRESS IN PRECISION FOR 125 YEARS

Brown & Sharpe BS

PRECISION TOOLS AND GAGES • MILLING, GRINDING AND SCREW MACHINES • CUTTERS
MACHINE TOOL ACCESSORIES • PUMPS AND HYDRAULIC PRODUCTS

LEVELS
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES
Bearings, Inc., 3634 Euclid Ave., Cleveland 15, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave. Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.

MACHINERY, Used and Rebuilt
Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Miles Mchry Co., 2025 E. Genessee Ave., Saginaw, Mich.
Van Keuren Co., Watertown 72, Mass.

MACHINISTS' SMALL TOOLS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The, L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES
Gorton Mch. Co., 1321 Racine St., Racine Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lufkin Rule Co., Saginaw, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES—Thread, Spline, Gear
Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass

MICROMETER HEADS
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St. New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING MACHINE ATTACHMENTS
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches, Inc., 4701 Marburg Ave., Cincinnati 9 Ohio
Fred-Tex Machine, Inc., Fredericksburg, Tex.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave.,

MILLING MACHINES, Automatic
Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Lamb, F Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Nichols, W. H. Co., Waltham 54, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

MILLING MACHINES, Bed Type, Simplex, Duplex
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks., Front St. and Girard Ave., Philadelphia, Pa.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

MILLING MACHINES, Bench, Hand
Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.

MILLING MACHINES, Circular, Continuous
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Nichols, W. H. Co., Waltham 54, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling
Arrow Engineering Co., 120 E. Market St., Indianapolis, Ind.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Colonial-Romulus Div., Parkgrove Station, Detroit 5, Mich.
Consolidated Mch. Tool Div.. Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St. Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

MILLING MACHINES, Knee Type Rise and Fall
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

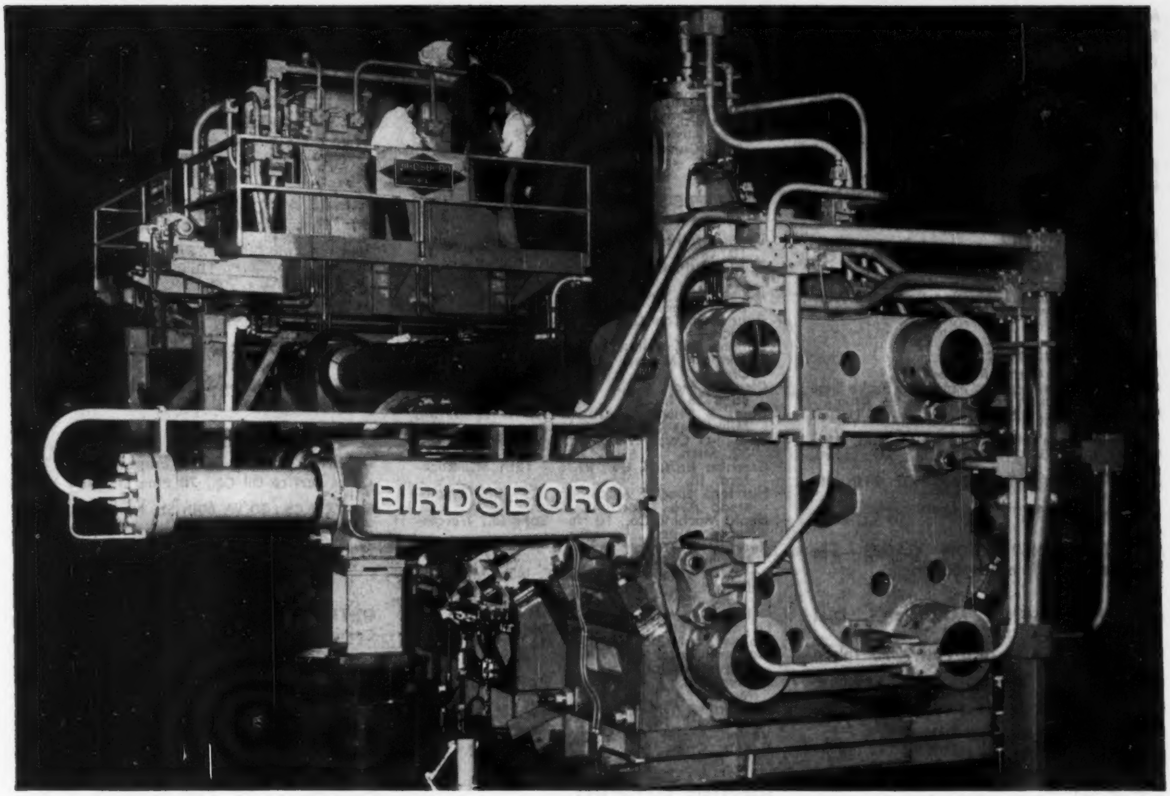
MILLING MACHINES, Knee Type Ram
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.

MILLING MACHINES, Knee Type Turret
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban. Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

MILLING MACHINES, Planer Type
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Spar
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecher Corp., 6784 W. National, Milwaukee, 14, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford. Ill.



For more data on any products advertised this issue use card, page 189

MOLDING MACHINES, Plastic
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

MOTORS, Air
Ingersoll-Rand Co., Phillipsburg, N. J.

MOTORS, Electric
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Lincoln Electric Co., Cleveland 17, Ohio.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic
Barnes, J. S., Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St.; Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
National Automatic Tool Co., S. 7th N. St. Richmond, Ind.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
La Salle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sundstrand Mch., Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

NIBBLING MACHINES
Wales-Strippit Corp., Akron, N. Y.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Il.

OPTICAL FLATS
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber Asbestos, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal
Mummert-Dixon Co., Hanover, Pa.

PIPE, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE AND TUBING MILLS, Electric-weld
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.

PIPE THREADING AND CUTTING MACHINES
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Available with single or double crank action, Cleveland's line of Open Back Gap Presses are available in a wide range of sizes and capacities, permitting the working of metal of almost any thickness from light sheet to heavy plate.

You get better stampings for less with a Cleveland Press.

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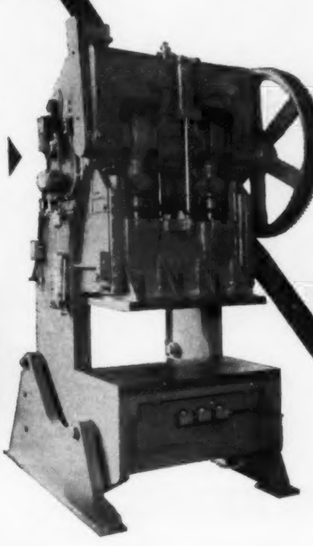
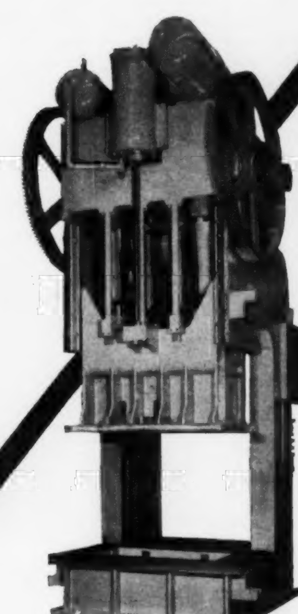
Stroke—10"
Adjustment—5"
Shut Height—22"
Bed Area—28 x 72"
Capacity—150 tons



MODEL 45G—42—75
Mounted on legs for inclining.
Stroke—6"
Adjustment—4"
Shut Height—17"
Bed Area—30 x 54"
Capacity—75 tons



MODEL G2—200
Stroke—22"
Adjustment—8"
Shut Height—60"
Bed Area—84 x 45"
Capacity—200 tons

THE CLEVELAND PUNCH & SHEAR WORKS CO.
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PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Consolidated Mch. Tool Div., Rochester, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A. Co., 3611 Woodburn Ave., Cincinnati, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

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Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

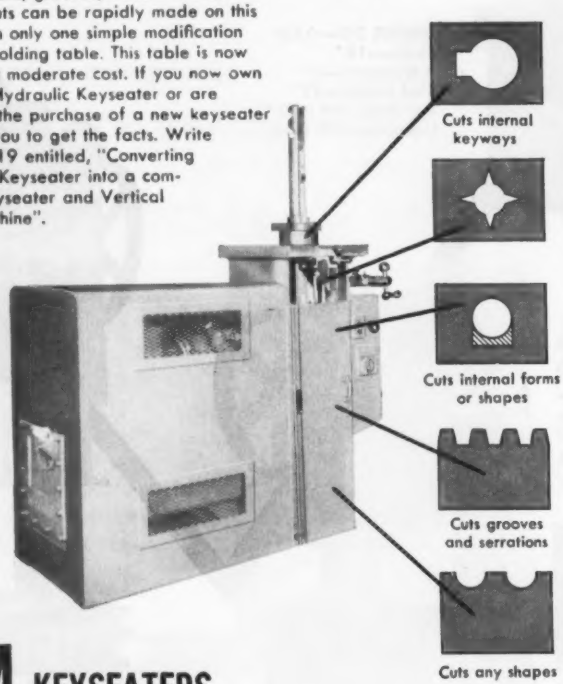
PRESS BRAKES—See Brakes, Press and Bending

PRESS FEEDER, Automatic

Bliss E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., 255 N. 18th St., Ampere, East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha Wis.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Wilson K. R., Inc., Arcade, N. Y.



PRESSES, Assembling

Alva Allen Industries, Clinton, Missouri
Bliss E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Blanking, Stamping

Alva Allen Industries, Clinton, Missouri
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E. Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 8th St., Ampere, East Orange, N. J.
V. & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting

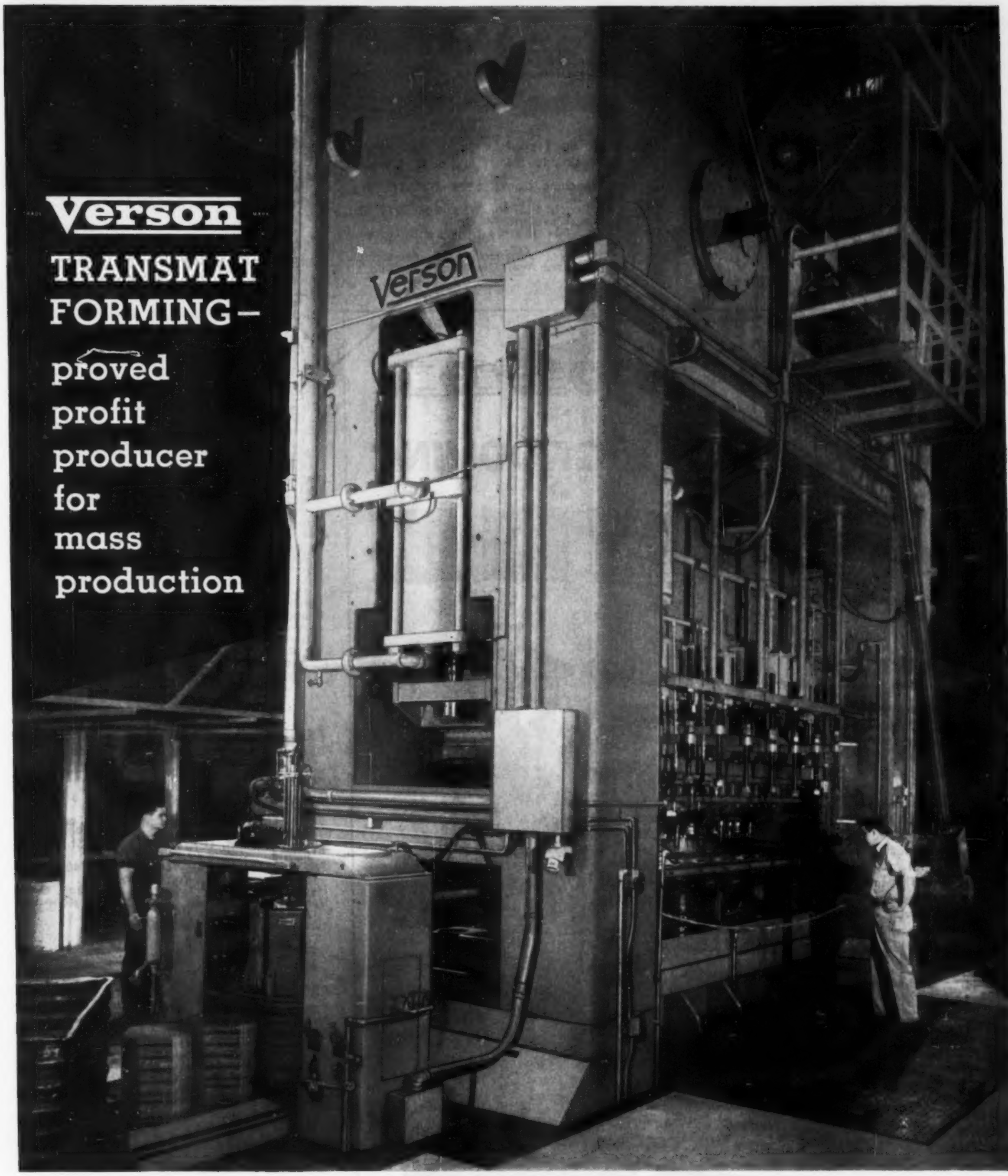
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E. Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.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Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Alva Allen Industries, Clinton, Missouri
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Famco Machine Co., Kenosha, Wis.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R. Arcade, N. Y.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Alva Allen Industries, Clinton, Missouri
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6399 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Extrusion

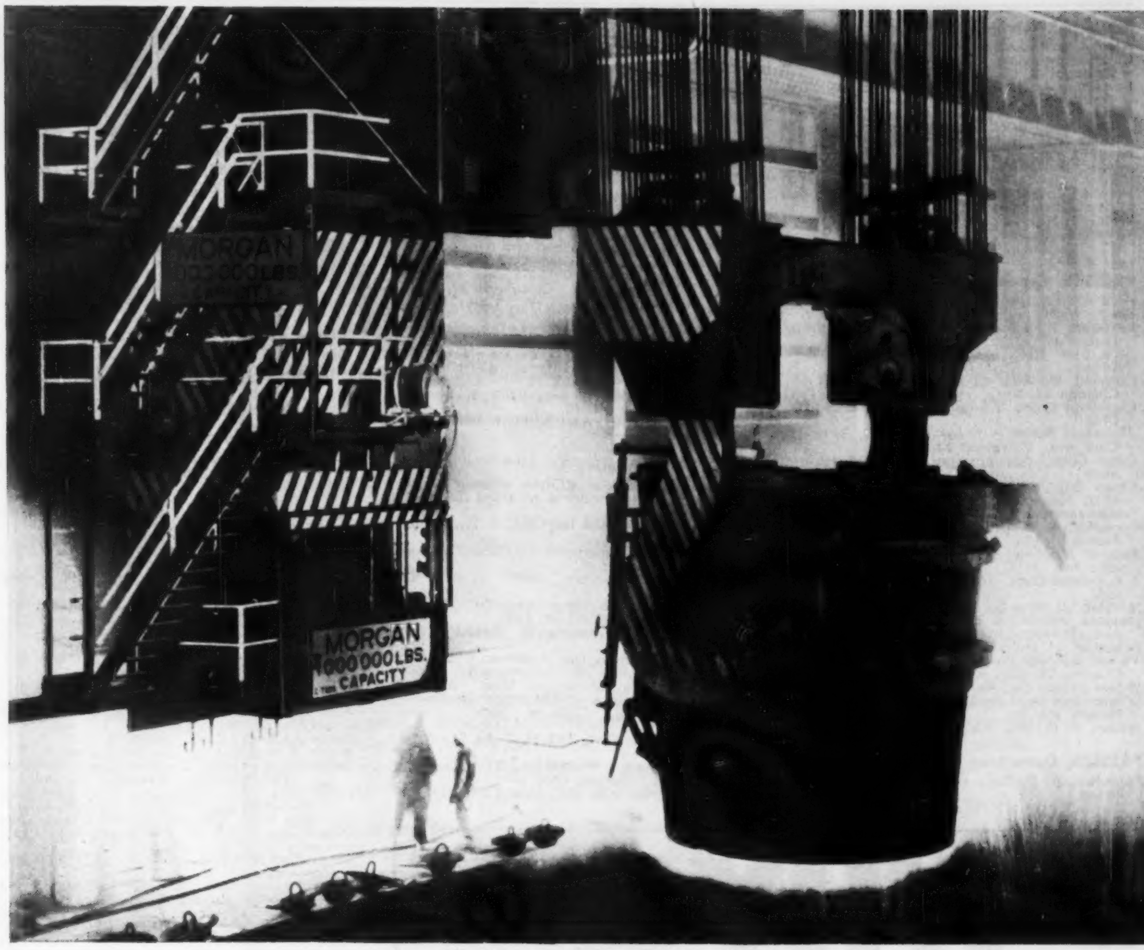
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Famco Machine Co., Kenosha, Wis.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.



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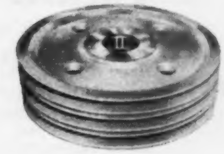

Sheaves ready for assembly on shaft and installation in lifting beam.

For bearings that accomplish the extraordinary in an ordinary manner, write, wire or 'phone Rollway Bearing Co., Syracuse 1, N.Y.

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PRESSES, Notching

Alva Allen Industries, Clinton, Missouri
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing

Alva Allen Industries, Clinton, Missouri
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Famco Machine Co., Kenosha, Wis.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Wiedemann Machine Co., Gulph Rd., King of Prussia, Penna.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Quenching

Farquhar, A. B. Div., 142 N. Duke St., York, Penna.

Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Trimming

Alva Allen Industries, Clinton, Missouri
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Dake Corp., 604 Monroe St., Grand Haven, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E.. Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

PROTECTORS, Thread & Tube

Maybrun, A. E. Co., 920 Ripley St., Santa Rosa, Calif.

PULLEYS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Little Giant Pump Co., 5101 Classen Blvd., Oklahoma City 18, Oklahoma
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 2, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic

American Engineering Co., Wheatsheaf Lane & Sepviva St., Philadelphia 37, Penna.
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Wilson, K. R., Inc., Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers Taper, Shell, Adjustable, etc.

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

REELS, Stock

National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

REFRACTORS Heat-Treating Furnaces

Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS FOR BEARINGS, etc.

Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Waldes Kohinoor, Inc., 47-16 Austel Place, Long Island City 1, N. Y.

RIVETERS, Portable

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

RIVETERS, Stationary

Brown & Sharpe Mfg. Co., 35 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

ROTARY TABLES, Optical

Machine Products Corp., 6771 E. McNichols Rd., Detroit 12, Michigan

RULES, SCALES AND STRAIGHTEDGES
See Machinists' Small Tools

RUST INHIBITORS

Kasenit Co., Mahwah, N. J.
Oakite Products, Inc., 26 Rector St., New York, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular Friction

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Mach. Works, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

SAW BLADE SHARPENERS

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Cutron Mfg. Co., Lubbock, Texas
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., Kenosha, Wis.

SAWING MACHINES, Circular Blade

Consolidated Mch. Tool Div., Blossom Road Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ty-Sa-Man Machine Co., Inc., Knoxville, Tenn.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

SAWS, Screw-slotting—See Cutters, Milling

SCREW DRIVERS, STUD AND NUT SETTERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Air Tools, P. O. Box 2119, Houston, Texas
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

SCREW MACHINES, Hand—See Lathes, Turrett, Ram-type, Saddle-type

SCREW MACHINES, Single-Spindle Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain- Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 31st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St. New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS—Oil or Grease
Bearings, Inc., 3634 Euclid Ave., Cleveland, Ohio
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

SEPARATORS, Magnetic
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Lufkin Rule Co., Saginaw, Mich.
Northwestern Tools, Inc., 117 Hollier Ave., Dayton 3, Ohio
Starrett, The L. S., Co., Athol, Mass.

SHAPERS, Crank and Hydraulic
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

SHAPERS, Vertical and Slotters
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rochford, Ill.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio

SHEARS, Guillotine Bar
Beatty Machine & Mfg. Co., Hammond, Ind.

SHEARS, Rotary
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

SHEARS, Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Famco Machine Co., Kenosha, Wis.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK
Laminated Shim Co., Inc., Glenbrook, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

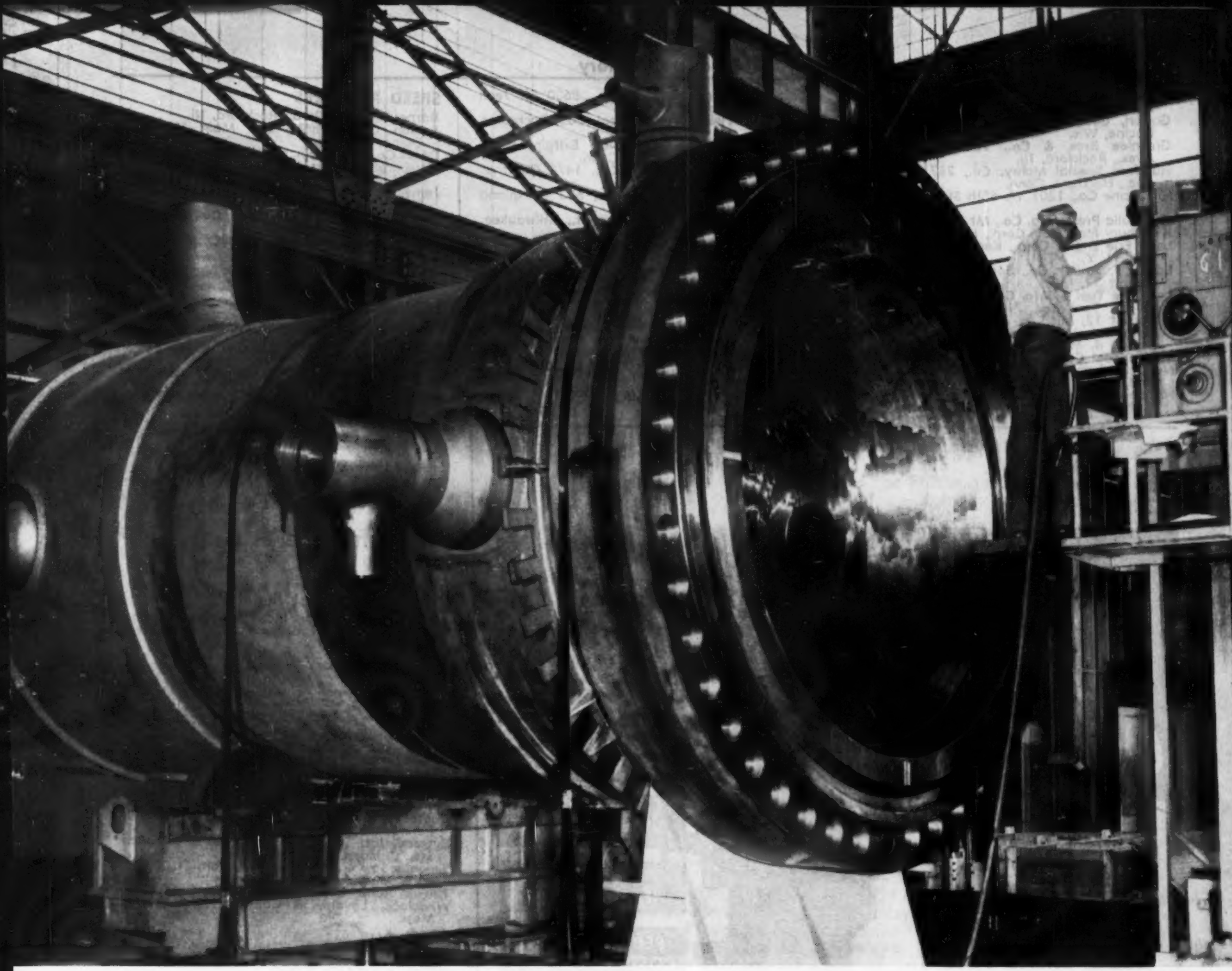
SLITTING MACHINES, Rotary
Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

SOCKETS—See Drill Sleeves and Extension Holders

SOLENOIDS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

SPECIAL MACHINERY AND TOOLS
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.



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Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
DoAll Co., Des Plaines, Ill.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

SPINDLES, Machine

Bearings, Inc. 3634 Euclid Ave., Cleveland 15, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N. St., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio

SPRAYING EQUIPMENT, Metal

Metallizing Eng. Co., Westbury, L. I., N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal

Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL ALLOYS—See Alloy Steels

STEEL, Cold Rolled, Stainless, High-speed, Tool, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL DISTRIBUTORS

Ryerson, Jos. T., & Son, 16th & Rockwell St., Chicago 8, Ill.

STOCKS AND DIES

DoAll Co., Des Plaines, Ill.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire

Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRIP AND SHEET, Non-ferrous

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.

Bridgeport Brass Co., Bridgeport, Conn.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRUCTURAL SHAPES

Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.

SWITCHES, Limit

Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N Sts., Richmond, Ind.

TAPPING HEADS

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPPING MACHINES

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Edlund Machinery Co., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio

TAPS, Hand, Machine Screw, Pipe, etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sheffield Corp., Box 893, Dayton 1, Ohio

TESTING EQUIPMENT, Air, Oil & Water Pressure

Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

THREAD CUTTING MACHINES

Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
National Machinery Co., Tiffin, Ohio
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
V & O Press Co., Hudson, New York

TIME RECORDERS

Lathem Time Recorder Co., Atlanta 8, Georgia

TOOL CONTROL BOARDS

Cross Co., 3250 Bellevue, Detroit 7, Mich.

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Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Cast Non-Ferrous Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Cleveland Twist Drill Co., 5214 W. Armstrong, Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Ceramic

Metal Carbides Corp., Youngstown 12, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, High-Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio

TRACING ATTACHMENTS
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati 2, Ohio
Atlas Press Co., Kalamazoo, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Wales-Strippit Co., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

TRANSFER MACHINES, Automatic—See Multiple-Station Machines

TRANSMISSION, Variable Speed
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio

TUBE-FLANGING MACHINES
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

TUBE FORMING AND WELDING MACHINES
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio

TUBE MILLS
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio

TUBING, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio

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Grieder Industries, Inc., Bowling Green, Ohio
Sheffield Corp., Box 893, Dayton 1, Ohio

ULTRASONIC MCH. TOOLS
Sheffield Corp., Box 893, Dayton 1, Ohio

VALVE CONTROLS
Barnes, John S., Corp., Rockford, Ill.
Logansport Mch. Co., Inc. Logansport, Ind.
Vickers, Inc., Detroit 32, Mich.

VALVES, Air
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Numatics, Inc., Milford, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave. Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Hts. Blvd., Detroit 20, Mich.

WELDING EQUIPMENT, Arc
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Gas
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Resistance
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Federal Mch. & Welder Co., Warren, Ohio

WELDING POSITIONERS
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

WELDMENTS
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Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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Scott Paper Co., Chester, Pa.

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Bethlehem Steel Co., Bethlehem, Pa.
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Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

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Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave. Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.

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Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago, Ill.
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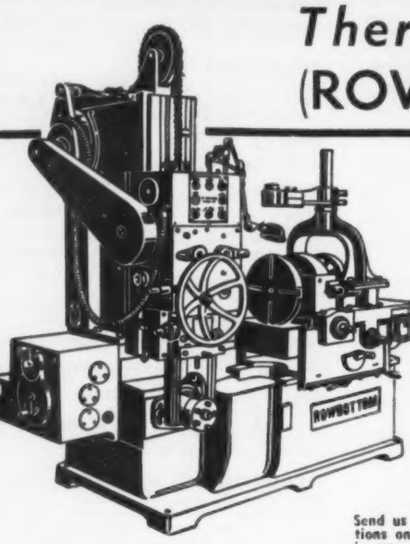

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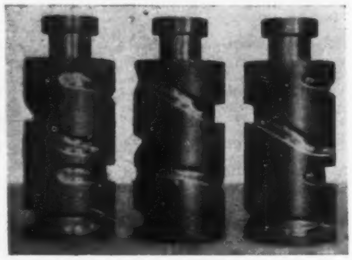

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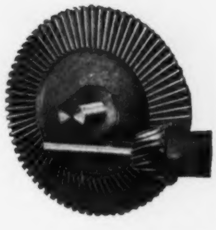

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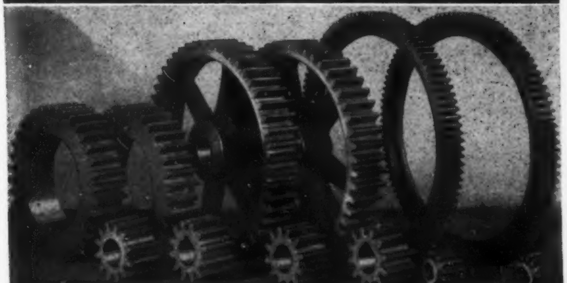

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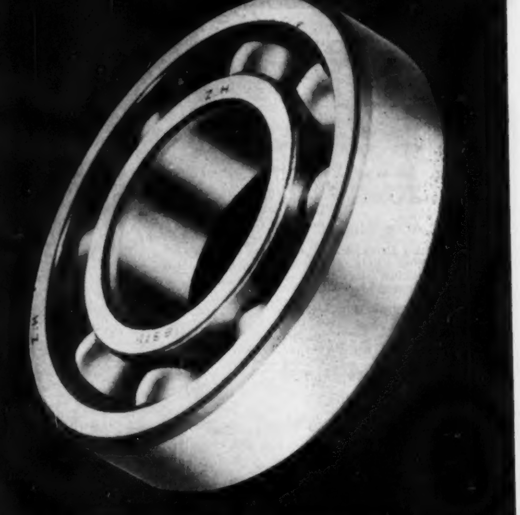

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15" National Broach Red Ring Gear Lapper, m.d.
18" National Broach Red Ring Gear Lapper, m.d. late

GEAR SHAPERS

Type Z Fellows Horizontal, m.d.
No. 4 Fellows Enveloping Gear Generator, m.d.
No. 12 Fellows Gear Shaving Machine, m.d., late
No. 7 Fellows, 1945
No. 7, 7A Fellows Gear Shapers, belted m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 61A Fellows, m.d., latest type, 1945
No. 615A Fellows Spur & Helical, belt drive
No. 645A Fellows, m.d.
No. 645A3 Fellows, vee belt drive
No. 645Y Fellows, m.d.
No. 70 Cross Deburring Machine, m.d., 1940
No. 72 Fellows H.S. Spur Gear Shaper, m.d.
No. 725 Fellows, 1945
No. 75 Fellows, H.S., m.d.
No. 75A Fellows, H.S. Spur & Helical, m.d.
No. 712 Fellows, m.d.
No. 7125A Fellows, H.S., m.d.

GEAR CUTTERS

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No. 36 Gould & Eberhardt Bevel & Spur Gear Rougher, m.d.
No. 36BM Gould & Eberhardt Spur Gear Cutter
No. 4B Fellows Gear Burnisher
No. 8B Fellows Gear Burnisher
3" Gleason Gear Generator, m.d.
8" Gleason Gear Generator, m.d.
11" Gleason Gear Generator, m.d.
48" Gleason Automatic Bevel Gear Planer, m.d.
No. 5AC Lees-Bradner Heavy Type Gear Generator, m.d.
No. 4-48" Brown & Sharpe, m.d.
No. 50 Cross Universal Gear Chamfering, m.d.
No. 50 Cross Clutch Miller, m.d.

GEAR HOBBING MACHINES

No. 3 Barber-Colman, m.d., in base, 1943
Type A Barber-Colman, m.d.
No. 1 Lees-Bradner Universal, m.d.
No. 12 Barber-Colman, Double Overarm, m.d.
No. 12 Barber-Colman, Single Overarm, m.d.
No. 34 Brown & Sharpe, m.d. spur & spiral
No. 180 Cleveland Vertical Rigid Hobber
No. 12H Gould & Eberhardt Universal Mfg. Gear Hobber, m.d.
Type T Barber-Colman, 1942

GEAR TESTERS

Type 8M Fellows Red Liner, m.d.
FPV-60 Maag Gear Wheel Co. Profile Testing Instrument
12" National Broach & Machine Co.
18" National Broach & Machine Co.
18" Gleason Bevel Gear Tester, m.d.
No. 471 Michigan Tool Co. Hob, Reamer & Gear Checker
National Broach & Machine Co. "Red Ring" Universal Gear Checker

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Kwik-Way Model H Piston Turning & Grinding Machine, m.d.

CENTERLESS GRINDERS

No. 2 Cincinnati, m.d.
No. 3 Cincinnati, m.d.

CARBIDE GRINDERS

No. 48C Excello Carboloy, m.d.

CRANKSHAFT GRINDERS

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22x72" Landis Type CH, m.d., late

CYLINDER GRINDERS

No. 50 Heald, m.d., 1945
No. 73 Heald Airplane Cylinder Grinder, m.d., new
No. 78 Heald Centerless Cylinder, m.d.

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No. 5D Gardner H.D. Polishing Stand

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No. 186-36" cap. Gardner, m.d., latest
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Model 372-53" Besly Single Spindle Vertical, m.d.

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No. 16A-2 Blanchard Auto. Rotary, m.d.
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14" Pratt & Whitney Vertical, m.d.
14" Pratt& Whitney Model M1640 Vertical, m.d.
No. A-1-8" Arter Surface Grinder
No. 22-12" Heald Rotary, m.d.
No. 25A-24" Heald Rotary, m.d.
No. 2 Brown & Sharpe, m.d.
#300-60 Hanchett Vertical Spindle, m.d.
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BORING MILL. 3¾" bar No. 5 Defiance, 1942
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CENTERING MACHINES. Nos. 53 & 56 Sundstrand up to 72"
GRINDERS, C'LESS. No. 12 Landis, 1947
GRINDER, CYL. 4" x 12" No. H. Landis, 1943
GRINDERS, UNIV. 14" x 14" Mod. 112 Rivett
GRINDERS, CYL. 20" x 72" Landis, 1943
GRINDER, INT. 72A5 Heald, Univ., Hydr.
GRINDER, INT. No. 74 Heald Hydr., 1941
GRINDER, SURF. 14" x 48" Mattison, 1942
GRINDER, SURF. 20" & 24" No. 25A Heald
GRINDER, SURF. 36" Nos. 18 & 16 Blanchard, 1940
GRINDER, CUTTER. 30" Ingersoll, 1942
GRINDER. CARBIDE. Nos. 48 and 49 Excello
GRINDER, RADIUS. No. 49 VanNorman, late
GRINDER, TOOL & CUTTER. No. 2 Cincinnati
HOB SHARPENER. Type HRS B rber Colman
KELLER. BL2416 Pratt & Whitney 3 Spdl., 1941
LATHE, ENGINE. 14" South Bend, late
LATHES, ENGINE. 13", 15" & 17" LeBlond
MILLER, AUTO. 48" No. 33 Sundstrand
MILLER, HAND. No. 2RV Kent-Owens, 1942
MILLERS. No. 10 & 3 VanNorman Duplex
MILLER, UNIVERSAL. No. 2H Kearney & Trecker, H.S.D.T.
MILLER, PLAIN. No. 2 Cincinnati
MILLER, VERTICAL. No. 2 Brown & Sharpe
MILLER. No. 36 VanNorman, ram type, 1942
OIL GROOVER. Wicaco Continuous, 1953
ROUTERS, Type A-1R Onsrud Radial 84", late
SAW. 6" x 6" No. 6 M rvel Hack, late
SAW. 10" x 10" Racine Hydr. Hack, 1941
SHAPER. 6" P&W vert., also 12"
SHAPER. 36" Rockford, open side
TAPPER No. 10 Warner & Swasey, 1948

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3' x 11" 3' x 13" Cincinnati Bickford Super Service Radial Drill.
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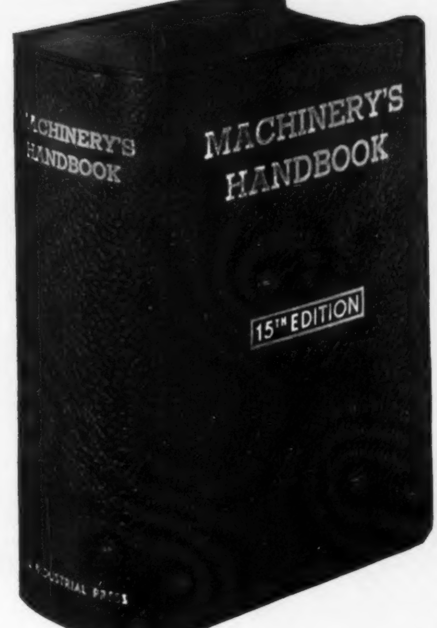

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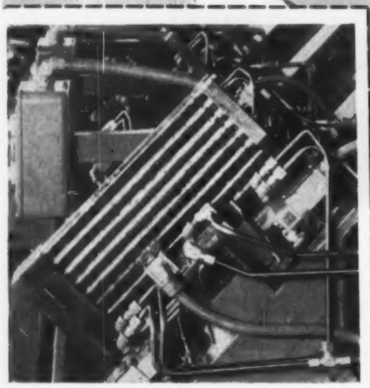

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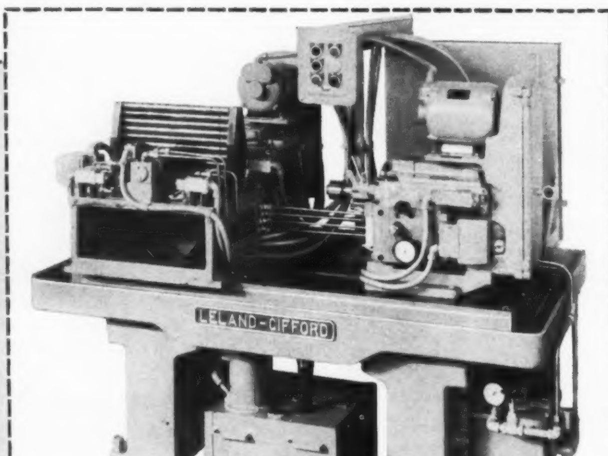

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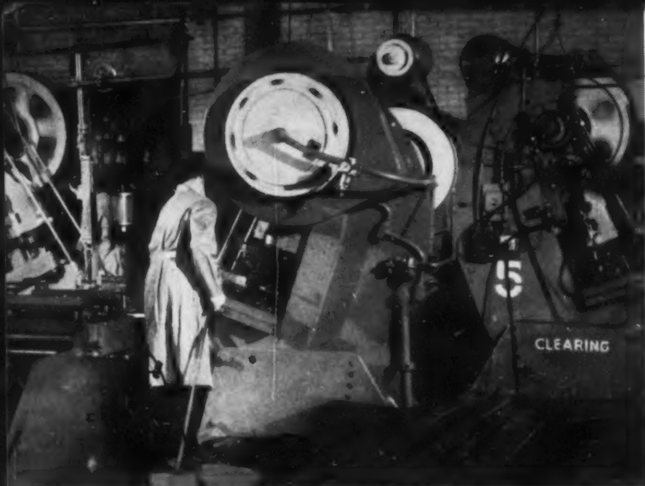

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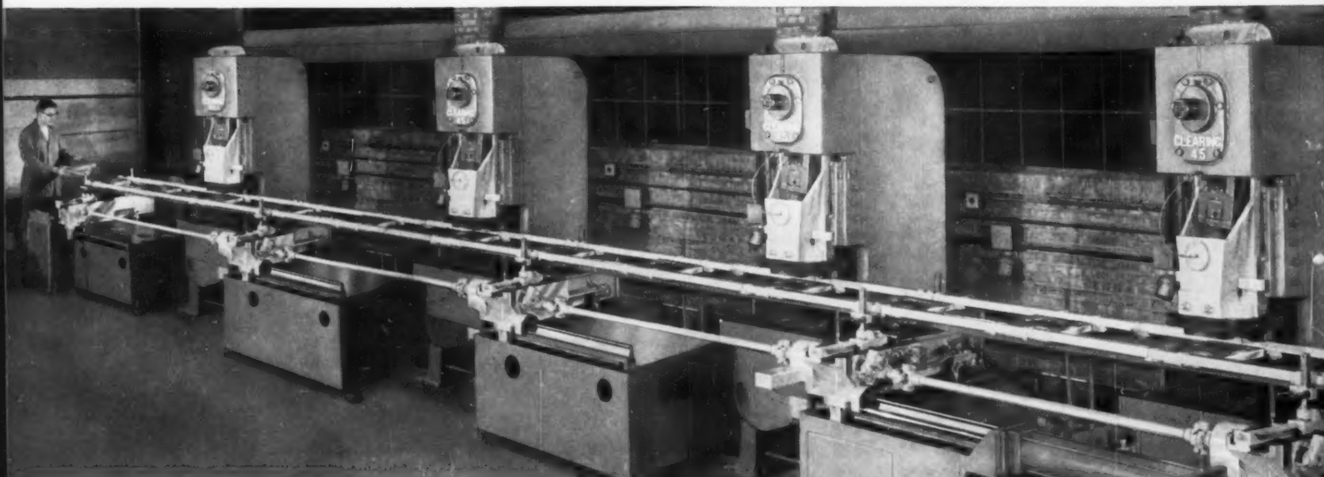

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